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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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A

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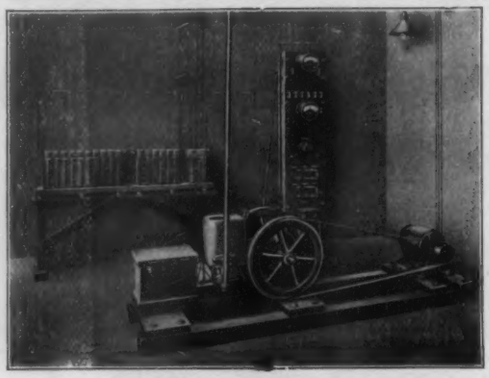
Alphabetical Index to Advertisers, Page 8. Where to Buy It in the West, Pages 10, 11.



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The sale and installation of electric lighting plants is a very profitable business. There are thousands of suburban homes, farms, summer camps, etc., where current from a Central Station is not available, whose owners will desire to install an electric lighting plant.

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Dealers and Contractors can make attractive profits on the sale of the plant apparatus, as well as on fixtures and by installing the plant and doing the wiring.

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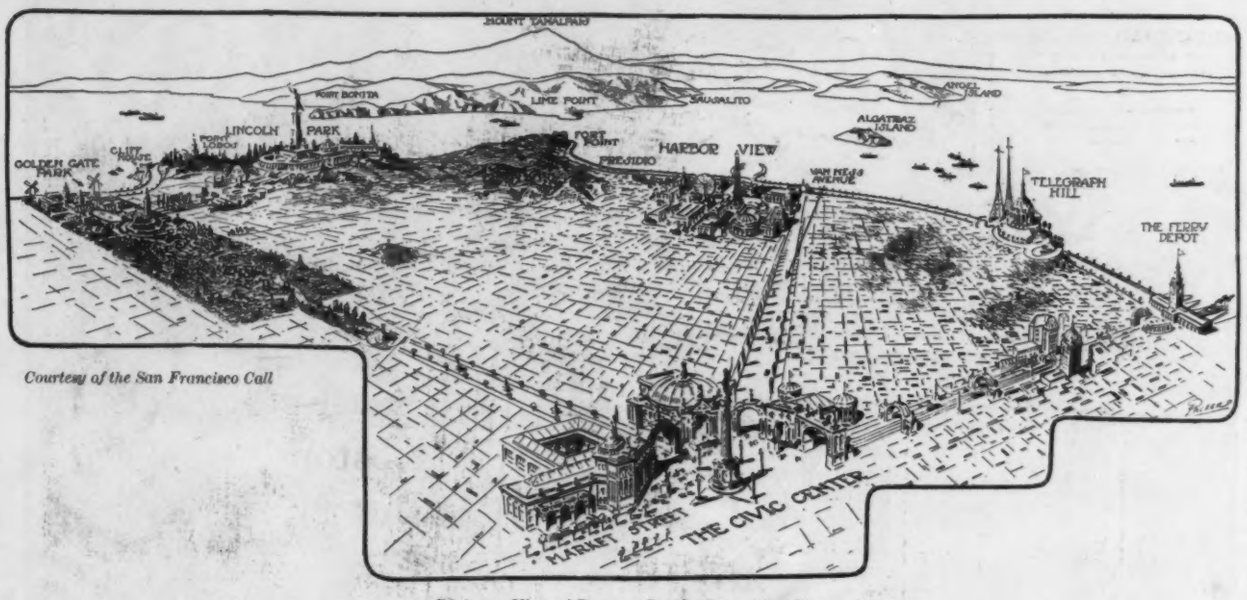


Courtesy of the San Francisco Call

Birdseye View of Panama-Pacific Exposition Site

EXPOSITION SITE TRANSPORTATION FACILITIES

On July 25th the Directors of the Panama-Pacific International Exposition Company came to a unanimous decision in the selection of a site for the great world's fair to be held at San Francisco in 1915. Briefly, the site comprises lands between Fort Mason and the Presidio, thence by ocean boulevard around the Presidio to and including Lincoln Park, adjoining Fort Miley, thence to Golden Gate Park, thus assuring ample space for all exposition purposes. This plan including parks, and running from bay to ocean, giving four miles of frontage along the Golden Gate, as C. C. Moore, President of the Exposition aptly put it, offers unlimited scenic beauties and architectural possibilities, and is particularly appropriate for the celebration of the greatest maritime event of the age in a great seaport.

As added features to the above scheme, it is planned to make use of Telegraph Hill and erect upon it the largest wireless telegraph station possible, by means of which the passage of the fleet through the canal can be continually signalled. The city park adjoining this monster monument, is to be improved with a permanent observatory and the sides of the hill beautifully terraced.

To finally cap the entire plan, a civic center with its convention hall and opera house, is planned for the heart of San Francisco, and it is suggested to locate the center near Van Ness avenue and Market street.

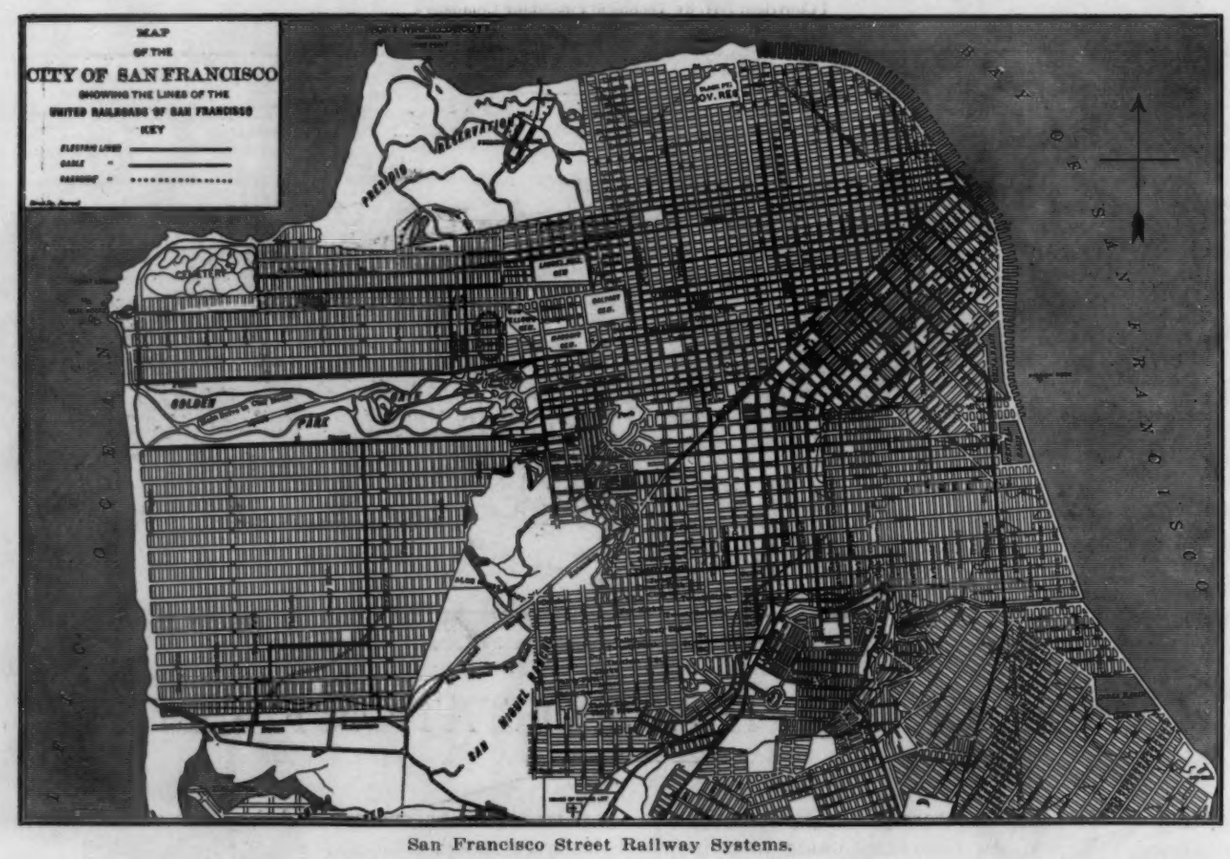
In reviewing this clever inspiration of the committee approval is voiced on all sides. The permanent buildings in the parks, the beautification of the parks themselves; the wonderful marine boulevard, and the suggested civic center—surely a city never had such a vision before in immediate prospect of realization.

As to the financial outlook $7,500,000 have been raised by subscription; $5,000,000 voted in city bonds; $5,000,000 raised by State tax; and many more millions will be contributed by the counties of California in their exhibit taxes. With this huge sum in view from home enterprise it is anticipated that an equal amount will be contributed by foreign countries and other States of the union. A contribution of $5,000,000 is confidently looked to from the national government

for building such buildings as may afterward be turned over for permanent barracks at the Presidio. This is in addition to the $10,000,000 available in the way of harbor bonds. Hence $50,000,000 is put as the amount that will be available as a financial enterprise.

John Barrett, Director-General of the Pan-American Union, has recently come to San Francisco after representing President Taft at the ground-breaking ceremonies of the San Diego Exposition, and aptly expressed a few words of comment as follows:

"All the world is preparing to reap the commercial benefits of the Panama-Pacific canal—all except the United States.



San Francisco Street Railway Systems.

"Every other great nation has long since begun to evolve the practical problems which will arise with the readjustment of the world's commerce when the canal is opened," continued Barrett. "But the United States has done nothing. Congress has a great task before it, in the settlement of tolls, canal administration, the relation of the canal to the Canal Zone Railroad, and in fact the whole of the vast machinery necessary for operating the big ditch.

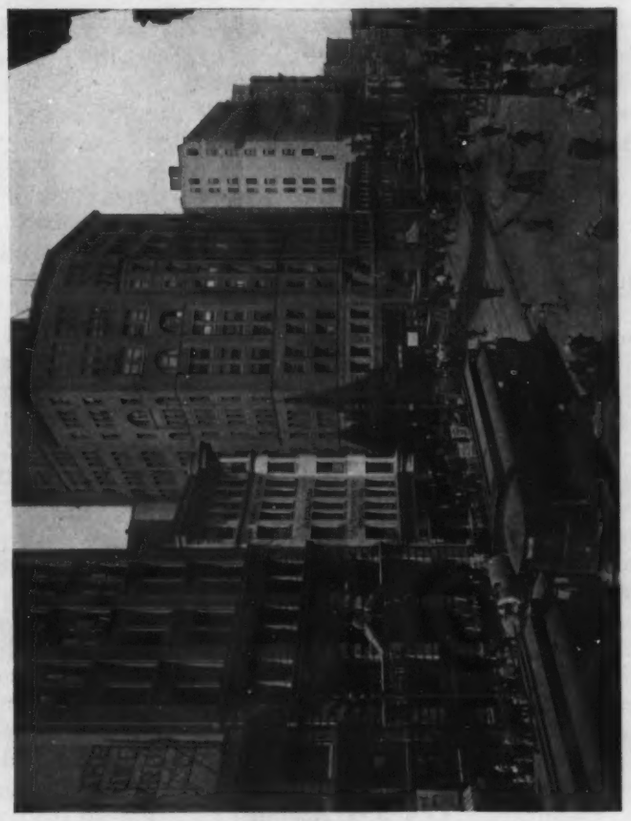
"Merchants all over the country must begin to study the canal and the effect it will have upon their business; importers and exporters must be ready with facilities and arrangements for meeting the new conditions of world commerce. Otherwise, the United States will be in the position of the man who builds a magnificent house and moves in before it is finished, before the plumbing is installed and before the glass is put in the windows.

"The great Panama-Pacific Exposition should not be a celebration of the opening of the canal so much as a celebration of the fact that the United States, and particularly California, is ready for the opening and ready to reap its immense advantages. I believe that the whole question of the success of the Exposition is up to San Francisco. The world, especially foreign countries, will accept the invitation to participate, for they are fully convinced that San Francisco intends to make this the greatest Exposition the world has ever seen.

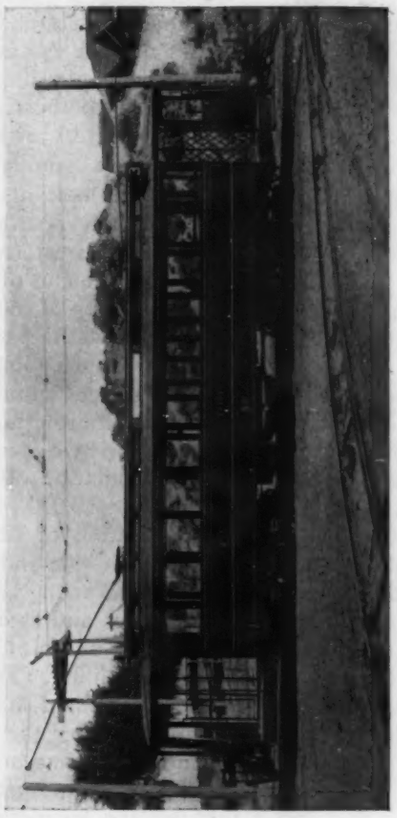
"The foreign countries can best be interested to contribute generously to the success of the Exposition by being assured that it will be a fitting celebration of what is everywhere considered the physical accomplishment of a marvelous engineering feat and the greatest single achievement in the interest of world commerce—in fact, the doing by the hand of man what God himself forgot to do in the busy creation of the earth."

Four years of time and thought in carefully planning to handle the mammoth crowds to be expected at the great exposition is none too little to have in view. Much thought can profitably be given to every phase of transportation. The proper supply of cars and the avoidance of confusion in their handling are items of extreme importance. The proposed plan simplifies congestion to a great extent in that more car lines are available for transportation and the choice of Harbor View will give to sight-seers a ready access to the Fair grounds by ferry-boat from Oakland, Berkeley and Marin county.

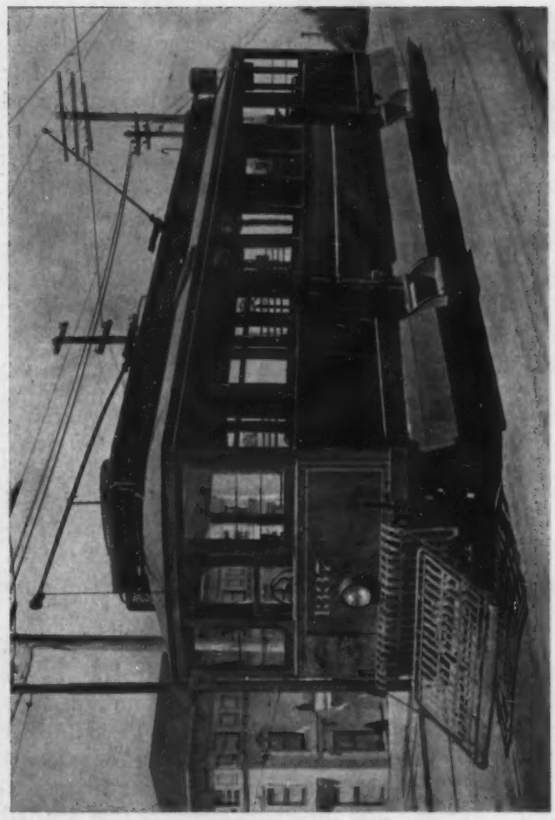
It will be well at this time, however, to go into the details of the make-up of San Francisco's street railways and far in advance spread knowledge as to difficulties to be encountered and thus allow ample



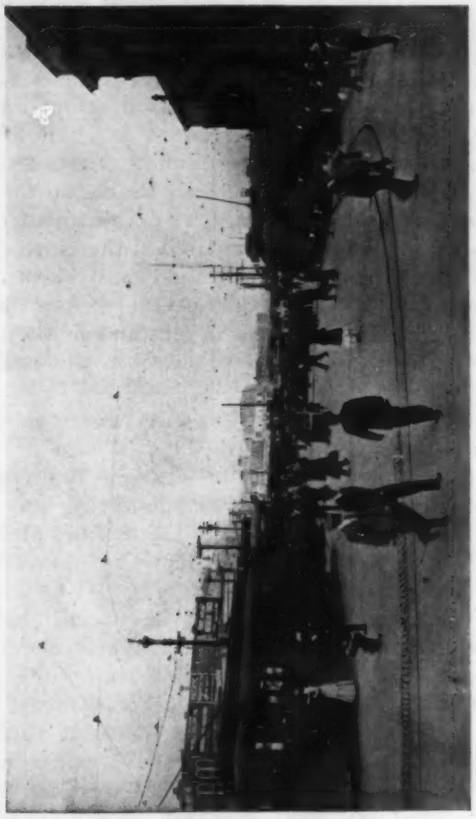
Most Crowded Center in San Francisco.



New Type of P-A-Y-E Car in Use in San Francisco.



Typical California Car—Open Type.



Crowded "Turn-Back" at Ferry Building.

time for the planning out of proper care for the anticipated congestion.

The T. G. Brill Company of Philadelphia have furnished many of the cars now in use in the city of San Francisco and as much valuable information has been compiled by them relative to the transportation facilities of the city, through courtesy of the company much of our information has been compiled.

It will be well at this time to look into the general geographical considerations of the exposition city. San Francisco, the largest city of the western half of the United States, is built at the upper end of a peninsula enclosing the southern part of a bay of the same name and is at the center of the long coast line of California. The city is nearly square in shape, about 7½ miles each way, with most of the streets running at right angles and the main business thoroughfare, Market street, bisecting it from the northwest corner to the southwest. The city has a population of 420,000 and the railway lines serve about 450,000. Across the bay is Oakland, with a population of 225,000 and a string of populous towns on each side and at different points on the bay, all connected with San Francisco by an extensive system of ferries and steamboat lines and contributing a large amount of traffic to the lines which converge at the Ferry Building, foot of Market street. At this point and at Third and Market streets occur the greatest congestion during the rush hours, which are from 6 to 8:30 in the morning and from 4:30 to 6:15 in the evening. The congestion is severe all along Market street through the business section, as it is the main artery of travel of the city and carries the bulk of the street car traffic. Parallel to Market and one block south is Mission street, which is next in importance as a business and traffic thoroughfare and which turns after leaving the business district and traverses the populous central section known as the Mission and continues to a short distance beyond the southern boundary line; the Mission street line extending the whole distance, about 7½ miles. Another long line, but nearer to the bay, serves this part of the city; and running to Ocean Beach, on the west side, are several long lines. The development of the outlying portions of San Francisco is therefore chiefly in these directions, and while the city belongs to the peninsular class, it will be many years before the limiting effect of the peninsula is felt, and in the meantime the development will proceed on the radiating plan.

The topography of San Francisco makes the street railway problem about as difficult as it is in any large city in the country. Generally speaking, the residence district consists of a series of hills involving very steep grades. The business section of the city lies along the bay shore and is fairly level. These lines in the majority of cases require operation on grades all the way from 27 per cent down. For this reason San Francisco was less inclined to take up electric traction than it might have been otherwise. Cable roads, in spite of their expensive operation, were generally used up to the early nineties, and suburban traffic at that time was handled with small steam locomotives. Gradually a few crosstown lines, whose grades were not heavy, were equipped with electricity and the only interurban line down the peninsular to San Mateo was built. Naturally these conditions had a marked influence on the type of rolling stock. The early cable cars consisted of two parts, the small framework, carrying the cable grip—known as the dummy—followed by a small trailer. Subsequently the dummy and trailer were combined in the same frame-work, making substantially a double-truck car. When electrical operation commenced, a car, which has since been known as the California type, was developed. This consisted, generally speaking, of a central closed portion with two open ends. In some of the cars the open ends had transverse seats, and in some the transverse seats faced outward. This car, having double trucks, was simply a growth of the original cable car idea, the climate of San Francisco being somewhat responsible for retaining the open section. During eight or nine months of the year it is sufficiently mild for outside riding, as a matter of preference, though heavy fogs and sudden chill winds require a closed portion for some of the passengers.

With the great fire of 1906, a complete rebuilding of the track within the burned area was necessary. While a gradual transition from cable to electric operation would probably have come about normally on account of the increased cost of operation of the cable road, the fire gave the opportunity for a complete change immediately. With an area of four square miles in ruins, the rebuilding was permanent and substantial. The total mileage of single track within the burned area was 60 operated by overhead trolley and 40 by cable. With the rebuilding, only two or three comparatively short lines were rehabilitated as cable lines, and these only because the grades were prohibitive from the standpoint of electric operation. The steepest grade in actual electrical operation at the present time is known as the Fillmore street hill, which is two blocks long, 27 per cent. This piece of track is operated, however, with a weight balance in addition to the trolley. There are in regular operation, without weight balance, grades several blocks long, 13 per cent, and a block each, 14 per cent and 16 per cent.

As an item of interest, while the combined electric and cable system of the city is now up-to-date and well operated, it is a peculiar fact that there is at present practically every type of traction lines actually in service, with the exception of the old steam dummy, which originally carried suburban traffic. Owing to a franchise dispute, a short section is still operated with horse cars. One short line, owing to property owners' dislike for overhead trolley, has the original cable dummy and trailer with cable operation. A few heavy grade lines are still operated with up-to-date double-truck cable cars, and the successive steps in types of traction and rolling stock are still represented up to the modern closed double-truck car arranged for fare prepayment.

With the exception of 11½ miles of cable railways of the California Street Cable Railroad, 7½ miles of the Geary Street, Park & Ocean Railroad, also cable, and 8 miles of electric lines of the Presidio & Ferries Railroad, all the street railways are operated by the United Railroads of San Francisco and consist of 261 miles electric and 14 miles cable. The United Rail-

roads has three different types of cars which might be considered standard, which are the California combination open and closed type which is operated on a number of the divisions; the cross-seat closed car, which is most prominent on the Market street and tributary lines; and the new P-A-Y-E cars, of which the first lot were put in operation five months ago on the Sutter-Jackson street and Cliff House lines, running across the northern part of the city. It is expected that there will be 80 of the latter cars in operation before the end of summer. The United Railroads system has in all approximately 600 electric motor cars and 50 cable cars. The three other railway companies together have about 100 cars.

Much forethought has been used in planning the handling of great crowds in other cities. The greatest problem to be solved in San Francisco is the question of constructing safe terminal facilities at the Fair gates which will permit a ready and safe means of transportation to and from the Fair for the thousands of visitors confidently expected. The experience gathered from similar Fairs will aid much, but after all, due to the peculiar topographic location of San Francisco new and original schemes will largely have to be contrived.

ANNUAL REPORT—COMMISSIONER OF PATENTS.

The annual report of the Commissioner of Patents, for year ended December 31, 1910, shows that the receipts of the office total over two million dollars. The applications numbered nearly 65,000; those issued, 36,000.

In more detail the report shows the total receipts were $2,025,536.69; the expenditures, $2,005,711.94, and the surplus of receipts over expenditures, $19,824.75. The total balance to the credit of the Patent Office in the Treasury of the United States on December 31, 1910, was $6,998,227.64. This is the smallest annual surplus in the Patent Office, with but one exception, for thirty-five years.

Previous to this period the salaries of the examiners had not been increased since 1848, or for a period of sixty years, which necessarily resulted in the loss, by resignation, of a large percentage each year of these highly educated and experienced men. At the present time, since the increase of salaries, the Commissioner has been able to retain a much larger percentage of these technically trained employes.

In proportion to population more patents were issued to citizens of Connecticut than to those of any other State—1 to every 1126. Next in order are the following: District of Columbia, 1 to every 1329; California, 1 to every 1616; Massachusetts, 1 to every 1623; New Jersey, 1 to every 1727.

The fewest patents granted in proportion to the number of inhabitants were in the following States and Territory: South Carolina, 1 to every 17,620; Mississippi, 1 to every 14,975; Hawaii, 1 to every 13,707; Georgia, 1 to every 12,192; North Carolina, 1 to every 12,056; Alabama, 1 to every 11,812; and Arkansas, 1 to every 11,662.

COSTS PER ACRE FOOT OF SMALL ELECTRICALLY DRIVEN PUMPING PLANTS.

BY E. C. METZ AND CLARENCE L. FRASER.

Much interest attaches to actual costs of operation in small pumping plants. Many reports of efficiencies high in value or of cheap costs of operation are rife. The data herewith presented represents average conditions, nevertheless, and it is hoped may serve its purpose in the way of creating a desire on the part of the small user to study conditions of operation and maintenance with greater care. A large field for improvement is open to the thoughtful user, as may be gleaned from the data herewith presented. Every step in the necessary calculations is put in print in this article so that anyone not versed technically can perform them on their own installation.

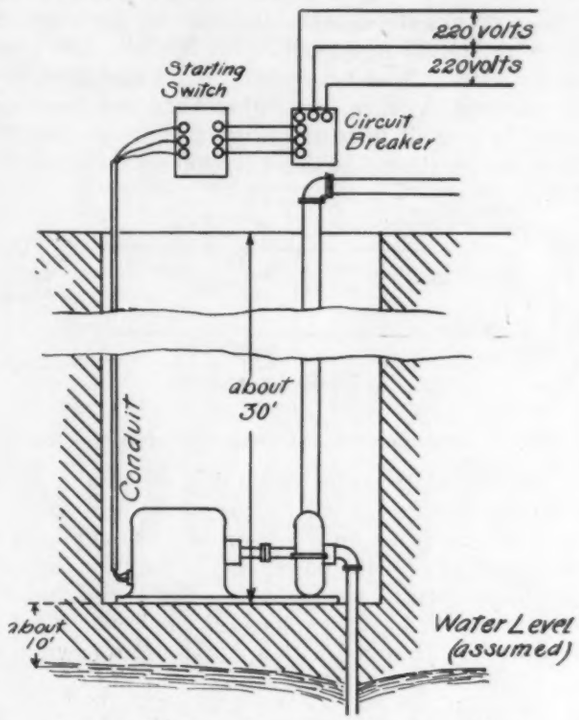


Fig. 1. Diagram Showing Motor Connections.

Irrigation by means of electrically operated pumps has only recently come into general use. The only near competitor of the electric motor is the gasoline engine. The advantages of the induction motor over other sources of power are, (1) the initial cost is low, (2) hardly any attendance is required even in pumping plants of large capacity and (3) the cost of repairs is much less.

The motors are generally direct-connected to the pumps and the combination put on one foundation, making a very small compact unit. In most cases the whole unit is put down in a shaft just above the water level. This is so the pump will have a very low suction head, generally not over fifteen feet.

The plants tested and studied in preparing this paper were situated at Exeter, Tulare County, California, and were selected with a view of getting plants that were representative of the above type in this district. Most of the water pumped is used to irrigate citrus groves, although some is used to irri-

gate orchards and vineyards. The pumping season begins in March and lasts through November. It was hoped to make the tests on these plants during the pumping season, but instead the tests were made in the early part of January. At this time the water level was probably a little higher than it would be during the pumping season.

The usual method of installing these plants is first to bore the required size of well to the necessary depth. Then a shaft about six feet square is excavated around the well to a depth of about thirty feet. The shaft is dug so the well will be in one corner. The shaft is then boarded up on the sides or curbed up with brick. The pump and motor, direct-connected, are then put in the bottom of the shaft.

The capacity of the motors vary from five horse-power to seventy horse-power but the average size of the motors is about seven and one-half horse-power. The average discharge head or lift is about thirty feet and the suction head varies from eight to fifteen feet. The starting switches, circuit-breakers and fuses are located in a small housing on the surface, so that the motor can be started without having to go down the shaft.

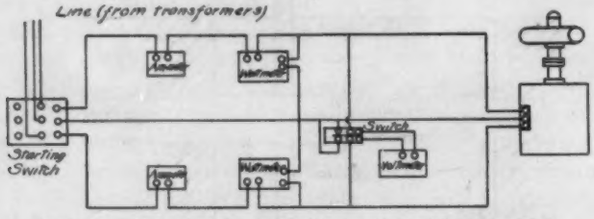


Fig. 2. Diagram Showing Connections Made in Test.

The secondary transformers that supply the power to the motors are owned by the consumers and are placed outside either on a pole or on a raised platform. The owner pays for the power loss in the transformers. The power circuits are two-phase three-wire and the power is supplied at 220 volts to the motors. Most of the plants are arranged with a double-throw switch so that when the pump is not being used the consumer has the privilege of using the power for lighting purposes. The consumer pays a flat rate of fifty dollars ($50.00) per horsepower per year, with the privilege of using the power for lighting purposes.

The tests herein recounted were made in January, 1911, and were carried out as follows. The instruments were connected in between the starting switch and the motor as shown in Fig. 2. Since the circuits are two-phase, a wattmeter and an ammeter were connected in each phase. A voltmeter switch was used and the voltage across each phase was obtained. The weir-box was set up as near the pump as practical and properly leveled.

Before any readings were taken a run of from thirty to forty minutes was made. By this time everything was running smoothly and the water seemed to be pumped down to a constant level. Readings were taken on the instruments and the hook-gauge read simultaneously. The static head remained constant throughout the test and was measured at the end of the test. The power input remained practically constant so that it was only necessary to take readings every fifteen or twenty minutes.

The instruments used in this test were two indicating 7½ kw. Weston Wattmeters, Nos. 3950 and 3026, and two Weston Ammeters, Nos. 62840 and 78025, and a Weston Voltmeter No. 6270. The wattmeters and ammeters were calibrated both before and after the tests were made. The voltmeter was calibrated after the tests were made and was found to be fairly accurate.

For measuring the water discharge a rectangular weir was made. The weir-box made of 1 inch boards was one foot deep by four feet wide by six feet long with the weir in one end. Boards were fastened in the box to check the velocity of the water. The weir was made of galvanized iron and was eighteen inches long. A hook-gauge, graduated to hundredths of feet, was placed 2½ feet back from the weir.

Four pumping plants in all were tested but the results of one test were rejected because sufficient data could not be obtained. In this paper the different plants will be known as

(1) **Plant No. 1.**
(2) Plant No. 2.
(3) Plant No. 3.

Plant No. 1 is owned by T. C. Ostrander and is located about oue quarter of a mile east of Exeter. The pump is used to irrigate fifty acres of oranges but is large enough, according to the owner to irrigate one hundred acres. The shaft is about thirty feet deep and is six feet square. The bottom has a floor of concrete and the sides are lined with concrete for five feet and the remainder with boards. The motor and pump are direct-connected and are placed down in the shaft. A small house is built over the shaft containing the starting switches and circuit-breaker. The discharge and suction pipes are six inches in diameter. The discharge pipe is brought up the side of the shaft and the water is discharged at the level of the ground into a wooden flume. The flume was about one hundred feet long and empties into a ditch. The weir was placed at the end of the flume and leveled up. The instruments were connected in as follows: Phase 1-Watt. No. 3950 and Am. No. 62840; Phase 2-Watt. No. 3026 and Am. No. 78025. The summary of details of Plant No. 1 and data compiled from test is as follows:

PLANT NO. 1.

MOTOR—
Westinghouse Type "C" Induction Motor.
H.P. 7.5.
Volts, 200.
Constant Speed. 2-Phase.
Speed, 1120 r.p.m.
Amperes per terminal, 19.5.
No. 121838. 60 Cycles.

PUMP—
3.5 inch Single Horizontal Cent. Pump.
Number of acres irrigated—50 A.
Cost per H.P. per year, $50.
Cost of installation—
Well complete with curbing.....$180
Motor and transformers..... 800
Total cost $980

TABLE I.
TEST ON PLANT NO. 1.
DATA.

Time of Read.	Output Weir h″	Output Weir h′	Input to Motor Phase 1 W_1	Phase 1 I_1	Phase 1 E_1	Phase 2 W_2	Phase 2 I_2	Phase 2 E_2
9:30	0.195	0.478	1.50	15.25	223.2	1.620	16.10	223.8
9:45	0.195	0.478	1.47	15.00	223.3	1.650	16.30	223.8
10:00	0.195	0.478	1.45	15.00	223.1	1.625	16.25	223.8
10:15	0.195	0.478	1.45	14.80	222.5	1.620	16.40	223.0
10:30	0.195	0.478	1.50	15.20	222.5	1.600	16.50	223.0

h″ is the zero reading on the weir in feet.
h′ is the final reading on the weir in feet.
h_s = 40.5 feet = The Static Head.

TABLE II.

CORRECTED DATA AND CALCULATIONS.

Weir Effective head	Input to Motor. Phase 1 Multiplier = 2			Phase 2 Multiplier = 2		
h	W_1	I_1	E_1	W_2	I_2	E_2
ft.	kw.	Amp.	Volts	kw.	Amp.	Volts
0.283	1.499	14.79	223.3	1.622	15.65	223.95
0.283	1.470	14.52	223.4	1.652	15.83	223.95
0.283	1.448	14.52	223.2	1.627	15.81	223.95
0.283	1.448	14.31	222.6	1.622	15.96	223.15
0.283	1.499	14.73	222.6	1.602	16.07	223.15
Average—						
0.283	2.946	14.57	223.02	3.250	15.86	223.63

$W_o = W_1 + W_2 = 2.946 + 3.250 = 6.196$ K.W. = Input = 8.3 h.p.

$E_1 I_1 = 223.02 \times 14.57 = 3249$ Volt-amperes.

$E_2 I_2 = 223.63 \times 15.86 = 3547$ Volt-amperes.

$E_1 I_1 + E_2 I_2 = 3249 + 3547 = 6796$ Volt-ampere input.

$$\text{Power Factor} = \frac{W_o}{EI} = \frac{6196}{6796} = 91.2\%.$$

CALCULATIONS FOR EFFICIENCY.

Discharge—

c — from Tables = .613 feet.
b — length of weir = 1.5 feet
h — effective head over weir = 0.283 feet.
Q = 0.741 Sec. Feet.

$$\text{Output} = \frac{Q\ p\ h_s}{550} \text{ H.P.}$$

h_s = Static Head = 40.5 Feet.
Q = Sec. Ft. = 0.741.

$$\text{Output} = \frac{.741 \times 62.3 \times 40.5}{550}$$

$$= 3.40 \text{ H.P.}$$

$$\text{Eff} = \frac{\text{Output}}{\text{Input}} = \frac{3.40}{8.30} = 41.0\%$$

Instruments used	Phase 1	Phase 2
Ammeters	62840	78025
Wattmeters	3950	3026
Voltmeter	6270	

Plant No. 2 is owned by H. Davis and is situated about one quarter of a mile southeast of Exeter. The pump is used to irrigate twenty-five acres. The motor is a 5 h.p. induction motor and is direct-connected to a 2½ inch horizontal centrifugal pump. The shaft is five feet square and is lined with boards. The motor and pump are placed diagonally across the bottom of the shaft. The discharge pipe is five inches in diameter and discharges into a wooden flume twenty feet long. The weir-box was placed at the end of the flume. The small house at the surface contained the starting switch and fuses. Watt. No. 3950 and Am. No. 78025 were connected in Phase 1 and Watt No. 3026 and Am. No. 62840 were connected in Phase 2. The summary of details of Plant No. 2 and data compiled from test is as follows:

PLANT NO. 2.

MOTOR—
General Electric Co. Induction Motor
Type 10-4-5a-1800. Form K
H.P., 5.0.
Volts, 220.
Constant Speed. 2 Phase.
Speed, 1800 R.P.M.
Amperes per terminal, 11.0.
No. 133903. 60 Cycles.

PUMP—
Price, New Style.
2.5 inch Horizontal Centrifufal Pump.
Number of acres irrigated—25 A.
Cost per H.P. per year, $50.
Cost of Installation, $900.00.

TABLE III.

TEST ON PLANT NO. 2.

DATA

Time of Read.	Output Weir h''	h'	Input to Motor Phase 1 W_1	I_1	E_1	Phase 2 W_2	I_2	E_2
11.30	0.204	0.399	0.90	9.50	249.0	0.88	9.50	248.7
11:50	0.204	0.399	0.92	9.50	249.0	0.88	9.50	249.0
12:10	0.204	0.397	0.95	9.60	249.0	0.86	9.60	249.0
12:30	0.204	0.397	0.94	9.60	249.0	0.86	9.60	249.5

h'' is the zero reading on the weir in feet.
h' is the final reading on the weir in feet.
h_s is the static head = 38.5 feet.

TABLE IV.

CORRECTED DATA AND CALCULATIONS.

Weir Effective head	Input to Motor. Phase 1 Multiplier = 2			Phase 2 Multiplier = 2		
h	W_1	I_1	E_1	W_2	I_2	E_2
ft.	kw.	Amp.	Volts	kw.	Amp.	Volts
0.195	0.939	8.60	249.0	0.880	8.77	248.70
0.195	0.919	8.60	249.0	0.860	8.77	249.00
0.193	0.949	8.70	249.0	0.860	8.87	249.00
0.193	0.939	8.70	249.0	0.860	8.87	249.5
Average—						
0.194	1.873	8.65	249.0	0.865	8.82	249.05

W_o = Total Input.
$= W_1 + W_2 = 1.873 + 1.73 = 3.603$ KW. = 4.83 H.P.

$E_1 I_1 = 249.0 \times 8.65 = 2154$ Volt-amperes.

$E_2 I_2 = 249.05 \times 8.82 = 2197$ Volt-amperes.

$E_1 I_1 + E_2 I_2 = EI = 4351$ Volt-ampere input.

$$\text{Power Factor} = \frac{W_o}{EI} = \frac{3603}{4351} = 82.9\%.$$

CALCULATIONS FOR EFFICIENCY.

Discarge—

c — from Tables = .622.
b — length of weir = 1.5 feet.
h — effective head over weir = 0.194 feet.
Q = 0.427 Sec. Feet.

$$\text{Output} = \frac{Q\ p\ h_s}{550} \text{ H.P.}$$

h_s = Static Head = 388.5 feet.
Q = Sec. Ft. = 0.427

$$\text{Output} = \frac{0.427 \times 62.3 \times 38.5}{550}$$

$$= 1.86 \text{ H.P.}$$

$$\text{Eff} = \frac{\text{Output}}{\text{Input}} = \frac{1.86}{4.83} = 38.5\%$$

Instruments used	Phase 1	Phase 2
Ammeters	78025	65840
Wattmeters	3950	3026
Voltmeter	6270	

Plant No. 3 that was tested was owned by E. J. Norcross and was used to irrigate forty acres. It is located one-half mile southeast of Exeter. The shaft was thirty-two feet deep and was six feet in diameter, the bottom of the shaft was cemented and the sides were curbed with brick. The motor was 7½ h.p. and was direct-connected to a 3½ inch centrifugal pump. The water was discharged through a six-inch pipe into a small concrete receiver. There were two small concrete flumes by which the water was carried from the receiver to the groves. The weir-box was set up just outside the receiver and the water flowed directly from the receiver into the weir-box. The same system of connections were used as before. Watt. No. 3950 and Am. No. 78025 in Phase 1 and Watt. No. 3026 and Am. No. 62840 in Phase 2. As in the other plants the small housing at the surface contained the starting switches and the circuit breaker. The summary of details of Plant No. 3 and data compiled from test is as follows:

PLANT NO. 3.

MOTOR—
Westinghouse Type C Induction Motor.
H.P., 7.5.
Volts, 200.
Constant Speed. 2-Phase.
Speed, 1120 R.P.M.
Amperes per Terminal, 19.5.
No. 262592. 60 Cycles.

PUMP—
Single Horizontal Centrifugal Pump.
Size, 3.5 inch.
Number of acres irrigated, 40 A.
Cost per H.P. per year, $50.

Cost of Installation—
Well complete with curbing..... $ 200
Motor and transformers..... 800
Total $1000

TABLE V.
TEST ON PLANT NO. 3.
DATA.

Time of Read.	Output Weir h″	Output Weir h′	Input to Motor. Phase 1 W_1	Phase 1 I_1	Phase 1 E_1	Phase 2 W_2	Phase 2 I_2	Phase 2 E_2
4.00	0.188	0.380	1.44	16.5	223.0	0.86	11.0	215.0
4.20	0.188	0.385	1.42	16.8	224.0	0.83	10.8	215.0
4.40	0.188	0.385	1.45	16.5	224.0	0.87	10.7	215.0
5.00	0.188	0.385	1.40	16.7	224.0	0.84	10.5	215.0

h″ is the zero reading on the weir in feet.
h′ is the final reading on the weir in feet.
h_e is the static head = 40.0 feet.

TABLE VI.
CORRECTED DATA AND CALCULATIONS.

Weir Effective head h	Input to Motor. Phase 1 Multiplier = 2 W_1	Phase 1 I_1	Phase 1 E_1	Phase 2 Multiplier = 2 W_2	Phase 2 I_2	Phase 2 E_2
ft	kw.	Amp.	Volts	kw.	Amp.	Volts
0.192	1.438	16.07	233.6	0.860	10.37	215.5
0.197	1.419	16.38	224.6	0.830	10.16	215.5
0.197	1.449	16.07	224.6	0.870	10.06	215.5
0.197	1.399	16.28	224.6	0.840	9.85	215.5
Average—						
0.196	1.426	16.20	224.35	0.850	10.11	215.5

$W_e = W_1 + W_2$ = Total Input.
$= 2.852 + 1.700 = 4.552$ KW. $= 6.10$ H.P.
$E_1 I_1 = 224.35 \times 16.20 = 3634$ Volt-amperes.
$E_2 I_2 = 215.50 \times 10.11 = 2178$ Volt-amperes.
$E_1 I_1 + E_2 I_2 = EI = 5812$ Volt-ampere input.

$$\text{Power Factor} = \frac{W_e}{EI} = \frac{4552}{5812} = 78.4\%$$

CALCULATIONS FOR EFFICIENCY.

Discharge—
c — from Tables = .622.
b — length of weir = 1.5 feet.
h — effective head over weir = 0.196 feet.
Q = 0.433 Sec. Ft.

$$\text{Output} = \frac{Q\,p\,h_e}{550} \text{ H.P.}$$

h_e — Static Head = 40 feet.
Q — Sec. Ft. = 0.433.

$$\text{Output} = \frac{0.433 \times 62.3 \times 40.0.}{550}$$

1.97 H.P.

$$\text{Eff} = \frac{\text{Output}}{\text{Input}} = \frac{1.97}{6.10} = 32.4\%$$

Instruments used	Phase 1	Phase 2
Ammeters	78025	62840
Wattweters	3950	3026
Voltmeter	6270	

Costs.

In calculating the costs it was assumed that two acre-feet of water were required for each acre of land per year, deducting for the rainfall. Following are the results calculated on this basis.

	Plant No. 1	Plant No. 2	Plant No. 3
Efficiency	41.0%	38.5%	32.4%
Cost per acre-ft. per ft. lift at $50 per h.p. per year	$.102	$.125	$.096
Cost per acre-ft. per ft. lift at $.01 per kw.-hr.	$.025	$.027	$.032

Conclusion.

The tests were made before the pumping season proper and the water level ordinarily is high at this time. But as it was an unusually dry season we have reason to believe that the water level was sufficiently near the average during the pumping season.

Taking the average of the three plants we have the following results:

(1) Average efficiency 37.5%
(2) Average cost per acre-foot per foot lift at $50 per h.p. per year ..... $.107
(3) Average cost per acre-foot per foot lift at $.01 per kw.-hr. ..... $.028

In conclusion we wish to acknowledge the kindness of the owners of these plants in allowing us to make the tests. Special thanks are due Prof. Noble and Mr. Gilcrest of the University of California for their valuable assistance.

ELECTRIC POWER FROM INDIA'S RAINFALL.

BY CONSUL EDWIN S. CUNNINGHAM, BOMBAY.

The Tata Hydroelectric Power Supply Company has been organized to furnish power for industrial purposes to this section of western India. This power will not be derived from permanent streams, but it is the company's intention to gather in reservoirs the very heavy rainfall, and use it for creating electric energy.

During the monsoon season, from the middle of June to the middle of September, there is a rainfall on the west coast of India that averages 175 inches at Lanouli, sometimes greatly exceeding this average. In the early part of the present century there was conceived the plan of storing this water and utilizing it for industrial purposes. After thorough investigation and reports of engineers, the money was practically secured in Europe in 1907, but final arrangements were not made, and as a result the entire capital of 20,000,000 rupees ($6,486,666) has been subscribed in India, making the enterprise purely an Indian undertaking. The present company was formally registered on November 7, 1910. It is the intention at first to supply 40,000 horsepower, which will probably be increased in the near future.

It is planned to erect three lakes or reservoirs. The Lanouli Reservoir, which will store water to be used during the three months of the monsoons, will be large enough to hold sufficient water during the longest breaks in the rain at that season. It will approximate 1000 acres, formed by a dam 3800 feet long and 26 feet high, and its cubic capacity will be 380,000,000 feet. The Walwhan Lake is the second reservoir and is to serve for the remainder of the year. It will be situated about a mile and a half from Lanouli, and will be formed between two spurs of hills by a dam 4500 feet long and about 68 feet high. The area of the lake will be approximately 2½ square miles, with a capacity of 2.600,000,000 cubic feet. The dam will be of solid masonry fitted with sluices.

Later on it is expected that a third reservoir will be constructed beyond Walwhan Lake, with which it will be connected by a tunnel nearly a mile long running through the dividing ridges of steep hills which will form a watershed some 1200 feet above the level of the valley. This reservoir will have an area of 3174 acres, or nearly 5 square miles, with a capacity of 7,000,000,000 cubic feet of water.

The water, traversing an aggregate distance of nearly 4 miles, will be led through masonry ducts from the lakes to the fore bay, situated 2040 feet above sea level. Here it will enter pipes 6 feet in diameter, which will run down steep slopes and precipices to Khopoli. The head will be a little over 1730 feet, the static pressure being 680 pounds per square inch. The generating station will be at Khopoli, 300 feet above the sea and 90 miles from Bombay, where it is planned to use the energy for manufacturing purposes.

The water supply, as has been stated, is dependent entirely upon the rainfall. This has been made a question of study, and engineers who have surveyed the grounds say that there is no danger of a shortage of water, but that the power is practically as certain as anything could be.

CODE OF ENGINEERING ETHICS.

BY AMERICAN INSTITUTE CONSULTING ENGINEERS

Code of Ethics.—It shall be considered unprofessional and inconsistent with honorable and dignified bearing for any member of the American Institute of Consulting Engineers:

(1) To act for his clients in professional matters otherwise than in a strictly fiduciary manner or to accept any other remuneration than his direct charges for services rendered his clients, except as provided in Clause 4.

(2) To accept any trade commissions, discounts, allowances or any indirect profit or consideration in connection with any work which he is engaged to design or to superintend, or in connection with any professional business which may be intrusted to him.

(3) To neglect informing his clients of any business connections, interests or circumstances which may be deemed as influencing his judgment or the quality of his service to his clients.

(4) To receive, directly or indirectly, any royalty, gratuity or commission on any patented or protected article or process used in work upon which he is retained by his clients, unless and until receipt of such royalty, gratuity or commission has been authorized in writing by his clients.

(5) To offer commissions or otherwise improperly solicit professional work either directly or by an agent.

(6) To attempt to injure falsely or maliciously, directly or indirectly, the professional reputation, prospects or business of a fellow engineer.

(7) To accept employment by a client while the claim for compensation or damages, or both, of a fellow engineer previously employed by the same client and whose employment has been terminated, remains unsatisfied, or until such claim has been referred to arbitration or issue has been joined at law, or unless the engineer previously employed has neglected to press his claim legally.

(8) To attempt to supplant a fellow engineer after definite steps have been taken toward his employment.

(9) To compete with a fellow engineer for employment on the basis of professional charges by reducing his usual charges and attempting to underbid after being informed of the charges named by his competitor.

(10) To accept any engagement to review the work of a fellow engineer for the same client, except with the knowledge or consent of such engineer or unless the connection of such engineer with the work has been terminated.

Schedule of Fees.—As a general guide in determining fees for professional services, the American Institute of Consulting Engineers recognizes the propriety of charging: **A,** a per diem rate; **B,** a fixed sum; or **C,** a percentage on the cost of work, as follows:

A—Per Diem Rate.

(1) Charges for consultations, reports and opinions should vary according to the character, magnitude and importance of the work or subject involved, and according to the experience and reputation of the individual engineer, from $100 per day to a higher figure, and in addition, where expert testimony is required or where otherwise conditions warrant so doing, a retainer varying from $250 to $1000 and upward. An additional charge should be made for all actual expenses such as traveling and general office expenses and field assistants and materials, with a suitable allowance for indeterminate items. In such cases six hours of actual work should be considered one day, except that while absent from the home city each day of twenty-four hours or part thereof should be considerad one day, irrespective of the actual hours of time devoted to the case.

B—Fixed Sum.

(2) A fixed total sum for above-mentioned services may be agreed on in lieu of per diem charges. A fixed sum may also be charged for a portion or all of the items of preliminary surveys, studies, examinations, reports, detail plans, specifications and supervision, including all of the expenses above recited in (**A**).

C—Percentages on the Cost of Work.

(3) For preliminary surveys, studies and report on original project, or for examination and report on project prepared by another engineer, including in both cases all expenses of every nature except those that may be specifically omitted by agreement—from 1½ per cent to 3 per cent on the work.

(4) For the preliminary stage (3) and in addition thereto detail plans and specifications for construction, including all expenses of every nature except those that may be specifically omitted by agreement—from 2½ per cent to 5 per cent on the estimated cost of the work.

(5) For the preliminary and middle stages (3) and (4) and in addition thereto general supervision during construction, including all expenses of every nature except those that may be specifically omitted by agreement—5 per cent, but more for work costing comparatively small amounts, and from 4 per cent to 5 per cent where the amount involved is considerable.

(6) For full professional services (3), (4) and (5) and management, including the awarding of contracts, and including all expenses of every nature except those that may be specifically omitted by agreement, 10 per cent; but more for work costing comparatively small amounts, and 6 per cent to 10 per cent where the amount involved is considerable.

(7) When desired, the percentage basis may be adopted for one or more stages, supplemented by a daily or monthly charge or fixed sum for the remaining stage or stages.

D—General Provisions.

(8) The period of time should be designated during which the agreed percentages and daily or monthly charges or fixed sum shall apply and beyond which period an additional charge shall be made.

(9) The percentages are to be computed on the entire cost of the completed work or upon the estimated cost, pending execution or completion.

(10) Payments shall be made to the engineer from time to time in proportion to the amount of work done.

(11) When alterations or additions are made to contracts, drawings or specifications, or when services are required in connection with negotiations, legal proceedings, failure of contractors, franchises or right-of-way, a charge based upon the time and trouble involved shall be made in addition.

BOWLING ALLEY LIGHTING.

BY F. W. LOOMIS.

Bowling alley lighting seems to be a subject upon which very little thought or study has been given in the past, at least one would so surmise on looking over the illumination of the average alley.

Taking the general run of alleys, the outlets are found spaced too far apart, and usually the light sources are unshielded, giving the effect of a few bright spots of light down the lenghth of the alley, together with a full quota of glare in the bowler's eye. Possibly the lamps are partially covered, but the outlets being unequally spaced give an unbalanced effect of light and shadows on the alley, which accentuates the glare from its smooth surface.

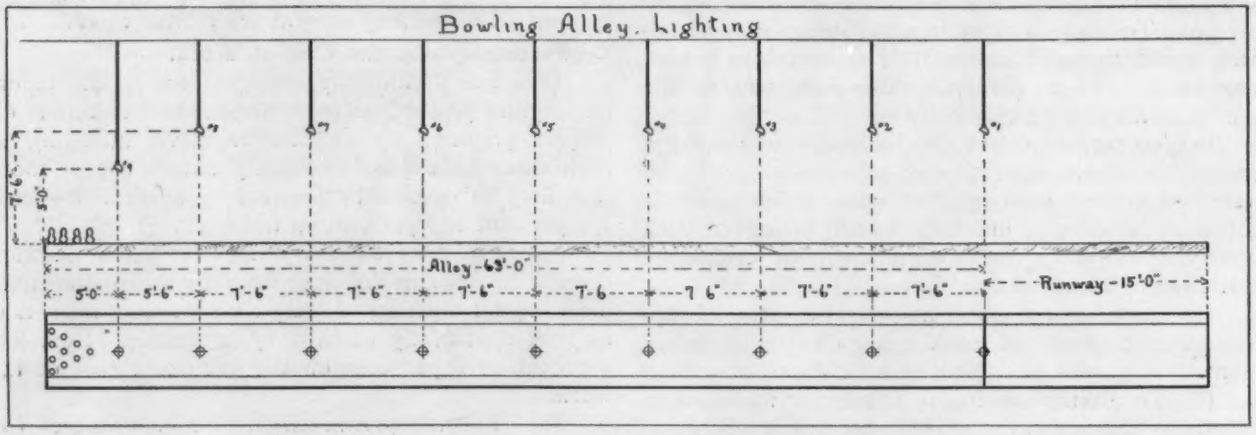


Fig. 1. Typical Illustration of Bowling Alley Lighting.

It is the object of this article to show what may be considered the best of systems for the illumination of bowling alleys, a system designed along scientific lines. The results are as follows:

1. The eye of the bowler is protected from glare.
2. The illumination down the alley is evenly balanced.
3. The pins stand out sharply at end of alley owing to a good strong intensity of light projected upon them at this point.

The length of the standard bowling alley is sixty-three feet, measured from the foul line to the end of alley. This does not include the runway. Over this length should be spaced nine outlets. (See illustration, Fig. 1). The first (No. 1) being placed over the foul line. Outlets Nos. 1 to 8 should be spaced seven feet six inches apart, and all eight should be hung seven feet six inches above the alley. The spacing between Nos. 8 and 9 should be five feet six inches and No. 9 mounted five feet above the alley, which will give a stronger light on the pins than over the balance of the alley.

The lamps are 40-watt clear Mazda or Tungsten, standard base, used with a thirty degree angle steel reflector (Holophane D'Olier No. 51). This combination of lamp and reflector will give an average intensity of illumination of 1.5 foot candles the length of the alley, and of 4.0 foot candles over the pins.

The light sources should hang pendant.

When two alleys are placed side by side, a single row of eight lights may be placed mid-way between the alleys—the spacing between units and mounting heights being maintained—but, of course, outlet No. 9 should be placed over the pins on each alley. Likewise two rows of units between may be used for three or four alleys. One row of light sources should never be used to illuminate more than two alleys. Either drop-cords or stems may be used, it being only essential that the units hang pendant.

Where the ceiling is low, as in some basement alleys, it is a good plan to conceal the units back of false beams. When this is done the type of reflector can be varied, using a steel or glass, focusing or concentrating type mounted on an angle receptacle, blocking the receptacle to point towards the pins, or down the length of alley, at approximately thirty degrees. A concealed system of this kind has a much better appearance than one where drop cords or fixtures are used.

Note:—Should long base 40-watt lamps be used, No. 54 Holophane D'Olier Steel Reflector should be used in place of No. 51

MODEL CONTRACT FORMS FOR ORNAMENTAL STREET LIGHTING AGREEMENTS.

The paper of L. S. Twomey delivered before the San Francisco branch of the A. I. E. E. on June 23d, relative to methods of calculating illumination has developed much thoughtful discussion among the readers of the Journal. One point which came up for discussion was the question of contracts given by a corporation to light certain streets in return for franchise privileges.

A valuable feature of the report of the Committee on Ornamental Street Lighting, which was delivered before the recent N. E. L. A. Convention in New York, was the set of model contract forms submitted, as embodying the best elements of the various agreements in force between central station, municipality and property owner in the different cities where the decorative lamp post has been successfully introduced. Several examples are of record of the danger which lies in insecure agreements that permit the neglect or abandonment of portions of the installation, where one of the original merchants moves away and the new tenant refuses to assume his obligation. Like-

wise, the adequate profit to the central station must be safeguarded and the uniform effectiveness of the installation maintained. Therefore, much depends on the form of contract on which the agreement is based.

The committee has offered this set of forms as a guide to companies who are fostering the ornamental street lighting idea and formulating their plans for its establishment.

I.

Agreement Between Company and Merchants' Association Covering the Installation and Maintenance of Ornamental Post Lighting System.

This agreement entered into this, the ..... day of ....., 19...., by and between the..... Company, party of the first part, and the Merchants' Association of the City of ....., party of the second part, to wit:

First: Party of the first part hereby agrees to furnish all labor and material necessary for installing an Ornamental Street Lighting System on ..... Street, between..... Street and ..... Street, a distance of .....feet for party of the second part. Said Ornamental Lighting System, consisting of ornamental posts similar to drawings herewith attached, and placed as shown in map herewith attached. Wires for lighting said posts will be laid underground in conduit, in approved manner, and switches for turning system on and off will be placed..... System will be complete from the mains of party of the first part to and including the last pole and will consist of conduits, wires, switches, posts, globes, lamps and al necessary appliances. Posts when set will be painted with one coat of ..... color graphite paint.

Second: Party of the first part will, during the term of .....year ..... from the time lights are turned on the system, furnish the necessary current for lighting said system from ..... each night, will turn system on and off nightly, will renew broken globes and lamps, will clean globes on the first and fifteenth of each month, and will paint each post with ..... color paint once each year.

Third: For the work specified in Section One, party of the second part agrees to pay party of the first part the sum of ..... Dollars ($.....) within one week from the time lights are turned on the system.

Fourth: For the service mentioned in Section Two, party of the second part agrees to pay party of the first part, on or before the tenth of each month following service, during the term of this agreement, the sum of ..... Dollars ($.....).

Sixth: In the case of outages on the system, party of the first part agrees to rebate party of the second part, monthly, for outages of the previous month at the rate of ..... cents per outage, per post per night.

Signed and sealed in duplicate, this the ..... day of ..... 19.....

.....
.....
.....
.....
.....

II.

Agreement Between Property Owners and Tenants Covering Installation of Ornamental Post System.

We, the undersigned property owners and tenants on ..... Street, between ..... Street and ..... Street, agree to pay to ..... the amounts herewith placed opposite our signatures, said amounts being the amount of our frontage figured at the rate of ..... per foot.

This payment is made to cover the cost of installation of a system of ornamental lighting on said street, specifications of said system being herewith attached and forming a part of this agreement.

It is understood that this agreement is not binding on the company unless all property owners and tenants on said street agree to pay for their frontage at the rate of ..... per front foot, and that it is not binding on the owners and tenants unless the City of ..... agrees to pay for the lighting and maintenance of said ornamental system, and the Company installs said system.

All payments are due within one week from time lights are turned on, and payable at the office of ..... Company.

Name.	Owner or Tenant.	Frontage	Amount.
.....			
.....			
.....			

III.

Contract Between Company and City Covering Maintaining System of Ornamental Post Lighting installed by Property Owners and Tenants State of .....:
..... County:

This contract made and entered into this, the ..... day of ....., 19...., by and between the ..... Company, a corporation under the laws of ....., with its principal office in the city of....., said State of ....., its successors and assigns, party of the first part, and the City of ....., a Municipal corporation of said State and County, party of the second part:

Witnesseth Whereas, there has been installed in the City of ....., a system of ornamental street lighting extending along ..... Street, between ..... Street and ..... Street, consisting of ..... ( ) ..... ornamental columns with .....( ) watt Mazda lamps on each column;

And, Whereas, there is about to be installed a similar system of ornamental street lighting extending along ..... Street from ..... Street to ..... Street, consisting of ..... ( ) columns with..... ( ) watt Mazda lamps on each column;

And, Whereas, the said columns and equipment of the same were and are to be erected under various contracts with property owners and others, whereby the said columns equipped were to be and become the property of the City of ..... and to be taken over into its contract as part of its public lighting system.

And, Whereas, the City of ..... desires to provide for the maintenance and operation of the said system of ornamental street lighting by the party of the first part.

Now, Therefore, in consideration of the premises and the mutual covenants and agreements herein contained, it is contracted by and between the parties hereto as follows, to wit:

The party of the first part shall, during the continuance of this contract, maintain and operate the said system of ornamental street lighting heretofore installed and hereafter to be installed as herein above set forth, shall renew the Mazda lamps from time to time as necessary, renew the broken globes and keep the posts painted and keep the globes and poles cleaned, and shall furnish the current for lighting and operating the said lamps and turn on the lamps and turn them off from time to time, the said lights to burn from ..... until ....on each night in the year. All the lamp globes shall be washed by the party of the first part on or about the first and fifteenth of each month during the continuance of this contract, it being the purpose that the said globes shall be washed twice each month, and they shall be subject to the inspection of the City Electrician.

The party of the first part agrees that all wires and cables supplying current to these lights shall be kept by it free from grounds and shall be maintained by it in first class condition.

The term of the contract shall commence from ..... 19...., as to the lights already installed, and as to the lights not heretofore installed, it shall begin as to each post from the date when the lamps on the said post are first lighted, and shall continue until ..... 19...., and from year to year thereafter, subject, however, to the right of either party hereto to terminate this contract at any time after..... 19...., by giving the other party written notice at least..... months prior to the time fixed in such notice for the termination of this contract.

The City of ..... shall pay the ..... Company for maintaining and lighting the said lamps as hereinbefore provided at the rate of ..... ($.....) Dollars per year for each post or column, said sum to be paid by the City of ..... in monthly installments on or before the ..... day of each month, during the term of this contract, for the lamps in use during the preceding month.

That for such time as any of the lights are out, there is to be deducted from the price to be paid for such light a proportionate part of the contract price for the time such light or lights are out.

In Testimony Whereof, the ..... Company has caused this contract to be signed in its name and behalf and its corporate seal to be affixed hereto by its President and Secretary, and the City of ..... has caused the same to be signed on its behalf and its corporate seal to be hereto affixed by its Mayor, hereunto duly authorized.

Executed in duplicate on the day and year above written as the date thereof.

by.....
Company.
.....
President
.....
Secretary
City of.....
by.....
Mayor

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Transportation Facilities Panama-Pacific Exposition

The entire West has fairly vibrated during the past week with enthusiasm over the selection of the official site for the Panama-Pacific Exposition to be held at San Francisco in 1915. Petty jealousies and friction of all sorts have been entirely forgotten in the hearty, public-spirited endorsement received from all quarters.

The big exposition is held primarily to commemorate the greatest engineering feat of history. The site as selected emphasizes the two points that above all others should be most strongly dwelt upon; namely, the Panama Canal as a maritime triumph and the Canal as an engineering feat. The site includes a boulevard over four miles in length along the famous Golden Gate entrance where the commerce and navies of the world can boast their supremacy in full review before the exposition grounds. Secondly, the site selected includes within its confines the very heart of the once burnt district of the great city. This very district will, in itself, in 1915 present to the world the greatest exhibit of all, namely, the product and faith of a brave people, ground to the earth but resurrected in two hundred million dollar splendor to greet the nations of the earth.

Even this early there begins to loom up for consideration the problem which will bear the most careful consideration. The question of transportation, systematic in make-up and absolutely void of confusion for those who will be strangers at the fair, is of utmost importance. The choice of the site for the fair has done much to meet these conditions. The grounds will be accessible from many points and the approach by boat at Harbor View will mean much to alleviate conditions incident to the heavy flux of people from Oakland, Berkeley, Alameda and Marin County.

It is more the question of proper terminal equipment at the grounds itself which will need thoughtful planning. No more pitiful sight can be imagined than a mass of helpless people crowding and jostling together, struggling and fighting to get on cars and absolutely ignorant of which particular car to take.

The human race, representing the highest type of the vertebrate animal, never appears more devoid of sense, judgment and reason than when in a crowd that is trying to get somewhere and nobody knows particularly where. On such occasions the more we are handled like our cousins, the cow, the steer, and the sheep, the better. Experiences of the past have demonstrated that the more nearly the corrals can be constructed to resemble the cattle-shipping approaches of the great packing houses, the better. To prevent the wild mob from running down the tracks, thus entering within the dangerous enclosures, even the cattle pit-falls and water tanks have been found most expedient in the past. After the completion of the work according to this design the corrals are made graceful and attractive in finish, kept clean and sanitary at all times and embellished with minute explanatory signs. With this worked out to the highest degree, those having charge of the transportation facilities will present to the world during 1915 another triumph of engineering sagacity.

Patent Reports

The annual report of the Commissioner of Patents for the year 1910 has recently appeared in press. Elsewhere in these columns will be found a summarized statement. Two points are of much interest in this compilation. The first is that, with the exception of California which appears third in the list, by all odds more patent fiends are found in the New England States, per capita, than anywhere else in the Union, and on the other hand the fewest in the Southern States and foreign possessions. Careful investigation explains this condition, not so much due to geographical conditions as to location of manufacturing centers where thousands of intricate mechanisms are manufactured and used. This goes to prove the old adage that "necessity is the mother of invention." In the South where farming is largely involved comparatively few inventions are necessary. Moreover these few, such for instance as the invention of the cotton gin, make neccssary when they take place a reorganization of the farming industry.

As to why California should appear so near the top of the list is hard to explain, unless it is that the delightful and healthful scenery and surroundings on the Pacific Coast are conducive to the development of the particular philosophical turn of mind which leads to invention.

Another item of interest in the report is that although the amount of money received during the past year was the greatest in the history of the patent department, yet a surplus of only $19,824.75 appears to its credit, the same being the smallest surplus, with but one exception, for over thirty-five years. In looking into the details of the commissioner's report it is found that various salaries in the department have been increased, as no increase had taken place for over half a century. This increase in salaries has resulted in the department's being able to retain their expert men and recall others who had left the service for more lucrative places during the past years. This item of salaries alone makes a difference of fifty thousand dollars in expenditure. We cannot help but feel that the increase in salaries to the deserving men in the department has been wise and will bear fruitful results in future service for the government.

College Engineering Thesis

The advance in engineering methods has been so great that it has been necessary to modify continually the course of studies preparatory to the granting of an engineering degree in the great technical schools. In order to adapt the course of study to the best needs of the future engineer it is necessary to note the progress of students after their graduation from college. To the careful observer one of the most striking features is found in the fact that after graduation so many of those preparing for the electrical engineering profession find their life work in mining or civil engineering, and those taking courses in civil and mining engineering make a marked success in, let us say, electrical or chemical engineering. The interesting feature of it is that the young student has been trained in a special technicalized subject, yet by acquired training and concentrated application he is enabled after graduation to master single-handed the matter relating to a kindred but hitherto untouched subject, so far as his previous personal knowledge is concerned.

These examples which are constantly being brought to our attention furnish much food for serious reflection to those interested in seeing the young engineer acquire the proper foundation work at college. After long observation and serious thought two features of the necessary college curriculum to be undertaken by the engineer in embryo stand out most prominently. One is, that above all things the fundamentals of chemistry, English, physics and mathematics should be so hammered into those planning a future engineering career, that if at any time through life they should be awakened from a sound sleep they could with ease repeat and apply these fundamentals. The use of logarithms, the elementary applications of trigonometry, and the fundamentals of the mechanics of physics, such as Newton's Laws of Motion, should be mere bywords. The illustration found upon the blackboard some years ago at the University of Montana is not so foreign to the case after all. The professor had constantly warned his students that above all things in the course of the mechanics of physics they should get Newton's Laws of Motion down pat. The next day appeared upon the blackboard an illustration of an Irishman with mouth wide open, one cannon ball just entering and several following at high velocity, with the title below "Get 'em down Pat." The only modification we suggest is that the Irish student should not be alone in masticating these fundamentals.

The other point in the engineering course is the thorough mastery of some one particular piece of experimental work performed with the utmost detail and accuracy. The word "thesis" is usually applied to this work but is not strictly accurate, for there is hidden in the word something which means that the work undertaken should of necessity be something not hitherto known or understood. The main point, however, so far as its value to the young engineer is concerned is that his experimental work should involve original thinking for him and should be a model of painstaking accuracy in every detail.

Examples of an excellent type of thesis have appeared in the two previous issues of the Journal and another example appears in this issue. These theses were undertaken by certain students in the mechanical and electrical engineering departments of the University of California. In the issue of July 22d appeared a new method of measuring velocities in small pipes. Papers for the patenting of this process are already filed. In the issue of July 29th some new experimental data on wind velocities of small wires seem to indicate a new law hitherto unproven, while in this issue appears a series of practical tests on cost of irrigation by means of pumps electrically driven. Such work as this means the consumption of much mental tissue on the part of the student in planning his work and at the same time prepares him to fight life's battles with every weapon at his command.

PERSONALS.

Nathaniel Ellery, State Engineer of California, was a San Francisco visitor during the past week.

John Coffee Hayes, general manager of the Mt. Whitney Power Company, of Visalia, is again at San Francisco.

R. Leo Van der Naillen, superintendent of the Oro Water, Light & Power Company, with headquarters at Oroville, was at San Francisco recently.

S. K. Colby, vice-president of Pierson, Roeding & Co., has been spending his vacation at the Bohemian Grove, on the Rusisan River, in Sonoma County.

E. G. Alexander, purchasing agent of the California Electrical Construction Company, has returned to the San Francisco house after spending a vacation at Visalia.

Colonel Frank H. Ray of New York, who is extending the hydroelectric system of the Rogue River Light and Power Company in Oregon, recently spent several days at San Francisco on business.

Sidney Sprout returned to his San Francisco office during the past week, from a trip to Dorris, Cal., where Sprout & Sprout have been retained as engineers for the installation of a municipal water system.

J. R. Wilson, sales manager of the Crocker-Wheeler Company, has returned to the factory at Ampere, N. J., after visiting the San Francisco agency while on a Pacific Coast tour in the interests of the company.

H. H. Noble, president of the Northern California Power Company, returned last Monday from an inspection tour, covering the Coleman station, the North Battle Creek dam, and the electric pig-iron plant at Heroult.

W. E. Barrett, chief gas engineer of J. G. White & Co. of New York, who recently arrived in California from Vancouver, B. C., spent the past week in consulting with H. A. Lardner, manager of the company's San Francisco office.

T. P. Strickland, chief assistant electrical engineer of the New South Wales Government Railways, with headquarters at Sydney, Australia, left for the East during the past week, after inspecting a number of the electric power plants in the vicinity of San Francisco.

H. V. Carter, president of the Pacific States Electric Company, and C. C. Hillis, general manager of the Electric Appliance Company, of San Francisco, will soon leave for the East as the delegates to the forthcoming annual convention of the National Electrical Jobbers' Association at Saratoga.

P. H. Coolidge, of the Pacific Telephone & Telegraph Company, has been transferred from the position of assistant general manager to that of general commercial superintendent and will remain at San Francisco. George B. Bush has been transferred from general commercial superintendent to assistant general manager, exchanging places with the former official.

Leo D. Haas, formerly connected with the lamp sales department of the California Electrical Construction Company at San Francisco, has taken a position in the commercial department of the Great Western Power Company, under J. H. Hornung. He is now working successfully at San Jose, which city the Great Western is preparing to invade with its electric transmission lines.

H. D. H. Connick, who was recently appointed director of works of the Panama-Pacific International Exposition, made an excellent record in the city engineer's office at San Francisco in charge of the new sewer system. Under his supervision, the first survey stake was placed during the past week in connection with the preliminary work of laying out the exposition grounds at Golden Gate Park.

F. W. Gay, of J. G. White & Co.'s Pacific Coast branch office, spent the past week in Southern California, looking over the electric power plant recently installed by his company, with a party of engineers. Among those who made an inspection of the Pacific Light and Power Company's large steam turbine generating plant at Redondo Beach were F. H. Varney and J. H. Wise, of the Pacific Gas and Electric Company.

ELECTRICAL CONTRACTORS' ASSOCIATION NEWS.

C. E. Schneider, of the Electric Supply Company of Sacramento, was in town during the week.

Q. R. Boynton, of the Central Electric Company of Los Angeles and San Francisco, has just returned from a month's stay in the South.

A. E. Brooke Ridley has just returned from a three weeks' fishing trip at Catalina Island, where he went to take in the Contractors' Convention.

In his talk before the electrical contractors at Catalina Island recently, H. V. Carter, president of the Pacific States Electric Company, used as a text the words of Judge E. H. Gary, chairman of the United States Steel Corporation, on the subject of "Co-operation."

"There should be established and continuously maintained," Judge Gary said, "a business friendship which compels one to feel the same concern for his neighbor that he has for himself. It is no less than the Golden Rule applied to business. Is it possible? Would it be certain to pay? It sometimes and too often happens that unfair action has been taken by those who have been given confidence by others, but this fact should dishearten no one.

"For example, take any two men in this room engaged in competitive business, but who are sufficiently acquainted to have the entire confidence of each other. Is there any doubt that in the daily conduct of their affairs neither would be disposed to do anything unneighborly or unreasonable toward the other; or that the acquaintance would bring to both better results than could be realized if they were unfriendly or engaged in bitter and destructive competition?"

The manner in which Mr. Carter handled the subject was excellent, and showed that in attaining his present high position that Mr. Carter was very familiar with all the branches of the business.

Secretary Hanbridge sends the following message to the California Electrical Contractors:

The Panama Exposition fair site has at last been decided, and now the question is being asked by every Californian, What will the next few years bring?

Let us electrical people answer it by saying and resolving that we are going to bring every possible electrical man and his family to California in 1915, thus doing our mite towards helping this great work along.

The electrical business will receive a great many of the benefits derived from this great undertaking and let us show our electrical brethren that we are a unit.

There will be a great many conventions held in our cities during the fair and there never was a better reason why every branch of the business should be working together. There is a large family of us, and that is all the more reason why we should all gather under one roof. We have our engi-

neers, who must lay out the work, then our manufacturing companies, to whom we must look to make the apparatus; the jobbers, who must supply the material; the central station men, who must furnish the current; our telephone and telegraph men, who must furnish communication with all the world; our contractors, who must install the apparatus; our electrical journals, whose men must give the world the news, and last, but not least, our Sons of Jove, who furnish the good fellowship and play that is necessary for our hardy workers to recuperate so that they can conquer other worlds.

Oh you Panama-Pacific Exposition, what would you do without us!!

So, fellows, from the viewpoint of the writer this is our share of the work, so lest we forget—

All together all the time for everything electrical.

FOREIGN NOTES.

KUALA LUMPUR, MALAY STATES.—The total cost of the electric lighting of Kuala Lumpur, capital of the Federated Malay States, is now placed at $1,075,656, and maintenance cost $75,595 in 1910. The receipts amounted to $96,760, a profit of $21,165, or 19.7 per cent, which is an improvement on the year previous.

SAN GERONIMO, MEX.—A public service electric company is now installing apparatus to bring electric current from San Geronimo to this town. Heretofore no electric current has been available to the public, the only plant being the plant of the Tehauntepec National Railway, and this company used the power in connection with the terminal and dock facilities.

CALCUTTA, INDIA.—The military authorities of the Government of India have a plan of wireless telegraphy to knit together the various units of the army in India. Details are lacking, but four stations have been completed and the wireless apparatus is to be installed by the Marconi company. This is the first appearance of the company in India, the system at present in use for commercial and general purposes being the Lodge-Muirhead system. The scheme is exclusively for military use and it is understood that eventually every military station in India will have its wireless apparatus in charge of trained army officers.

BANGKOK, SIAM.—The Siam Electricity Co., (Ltd)., which owns the only large electric light plant in Bangkok, also the tram car lines, paid the usual dividend of 12 per cent and a bonus of $2.22 per share of $50, on 25,000 shares. It is said that the Siamese Government has decided to install its own electric power plant for the water-supply system, and also intends to provide electricity for lighting the palaces, parks, and districts adjacent to the pumping station. The electrical company now supplies the current for this lighting and if the Government should take over this work the company will sustain considerable loss fo revenue.

TRADE NOTES.

The Bunker Hill Mining Company at Amador City recently placed in operation a new 300-h.p. Westinghouse electric-hoist motor It operates a 2500-foot shaft with rope-drive connection.

The Hughes Electric Company of Glendive, Mont., has contracted with the Kellogg Switchboard and Supply Company of Chicago for a complete new central station and subscribers' stations. This system connects with the long-distance lines of the Eastern Telephone Company.

The Kellogg Switchboard and Supply Company has closed a contract with the Mount Hood Railway and Power Company of Portland, Ore., for a telephone system for their twenty-nine-mile electric railway line extending to Bull Run. Dispatchers and way station equipment, and Gill selectors are called for by the specifications. Gordon Kribs is the chief engineer. The first section of the road will soon be ready for operation.

The Western Electric Company recently sold to the United States Government a complete central battery exchange equipment to be installed at West Point, New York. This equipment consists of a multiple switchboard with a capacity of 3000 common battery lines, together with frames, racks, a complete power plant and 25,000 feet of paper insulated, lead covered underground cable. In addition to this, the contract calls for all the necessary telephone sets, protectors, outside distributing wire and the installing and connection of the underground cable.

The General Electric Company has been awarded a contract for a novel electrical installation for the United States collier Jupiter, now under construction at the Navy Yard, Mare Island, Cal. A 5450 kw. Curtis steam turbine generating set will supply three-phase current, to operate two slow-speed induction motors, each direct connected to one of the twin-screw propeller shafts. The nearest approach to this installation now in use in this country is in one of the Chicago fire boats with capacity of only 700 h.p. The new contract calls for one horizontal, 6-stage Curtis turbine, direct connected to an A. T. B. 2, 5450 kw., 1990 r.p.m., 2300 v. generator. Also, two I. 36, 2750 h.p., 110 r.p.m., Form M., 2300 v., variable-speed induction motors with water-cooled resistances. Also the necessary switchboards.

The Wagner Electric Mfg. Company of St. Louis has consummated arrangements with the Mine & Smelter Supply Company by which the latter concern will act as representative for the Wagner Company in the territory tributary to Denver, Salt Lake City, El Paso and Mexico City, Mexico. The Mine & Smelter Supply Company is the largest mining machinery house in the country. They, however, do not confine themselves to machinery and supplies required in the mining and smelting industry but also handle all classes of machinery in the districts covered by their stores and warehouses above enumerated. Mr. O. H. Davidson, heretofore the Wagner representative at Denver, becomes head of the electrical department of the Denver house of the Mine & Smelter Supply Company. In Salt Lake City, Mr. F. E. Marcey, for several years manager of the Salt Lake City office of the Allis-Chalmers Company, is manager of the Mine & Smelter Supply Company's office.

NEW CATALOGUES.

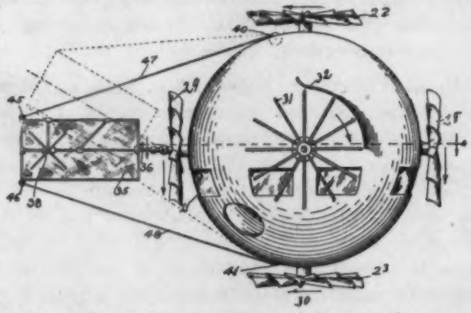
The Griscom-Spencer Company, 90 West Street, New York, have just issued Catalog No. 402 on the Thompson Evaporative Condenser, Catalog 1101 on the "Stratton" Steam Separator, a catalog on the G-S Hygienic Air Washer, and Bulletin 701 on the Morse Destructor Furnace.

The Fort Wayne Electric Works have just issued Bulletin No. 1130 on Northern Type K Direct Current Motors, Bulletin No. 1131 on Series Incandescent Street Lighting Systems, Bulletin No. 1132 on Multiphase Revolving Armature Alternators, Bulletin No. 1133 on Single-phase Watthour Meters, Type K4. The four bulletins are profusely illustrated.

Folders 4204 and 4205 are the new publications that are being distributed by the Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa. No. 4204 is entitled "Telephone Battery Charging with Westinghouse-Cooper Hewitt Rectifier Outfits," and No. 4205 is entitled "The Right Light," and covers the use of the rectified current arc lamp with moving picture machines. These folders will be sent to anyone interested on application to the Westinghouse Department of Publicity.

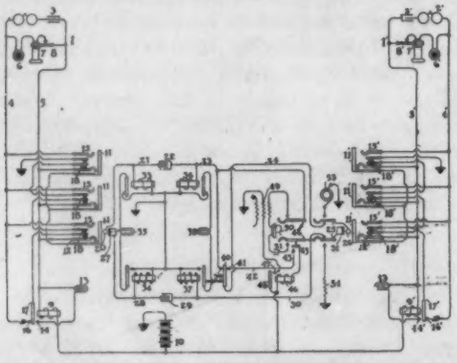
PATENTS

998,683. Centrifugal Aeroplane. Joseph W. Fawkes, Burbank, Cal. An air ship having a hollow spherical body, a rear shaft extending horizontally through the rear wall of said body, a propeller carried thereby for advancing said body, a steering vane having universal connection at the rear end of said shaft, cords connecting with the end of said steering vane and passing through the wall of said body on



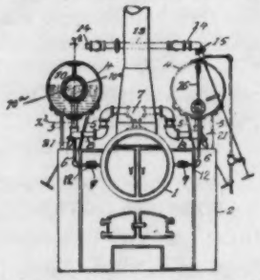
opposite sides thereof and substantially at the same level, means for operating said cords to move said vane to the right or left of said horizontal shaft, a pair of cords connected with said vane and passing through the walls of said body on the upper side thereof and on the under side thereof, means for adjusting said last pair of cords for elevating or depressing said last steering vane, and means for driving said propeller.

998,719. Telephone System. Charles A. Simpson, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill., a Corporation of Illinois. In a telephone system, the combination with a telephone line, of a source of current, a relay having its coil normally connected between



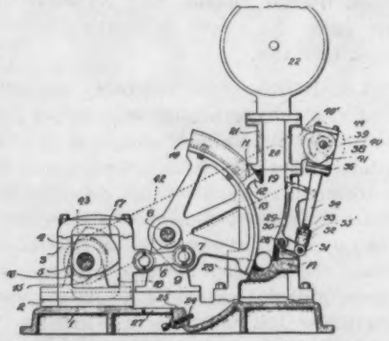
a pole of said source and a limb of said line, and the other limb of said line being normally connected with the other pole of said source through contacts of said relay, a line lamp, the actuation of said relay being adapted to complete a locking circuit through said line lamp and the coil of said relay, substantially as described.

998,816. Water Feed, Heater, and Purifier for Steam-Boilers. Samuel M. Walker, Los Angeles, Cal. A water feed, heater and purifier for steam boilers, comprising a firebox, a boiler shell supported by the firebox, two horizontally arranged drums supported on the firebox, one on each side of and above the boiler shell, pipe connections each having a valve and extending from the lower part of the outer end of the drums to the boiler shell, a centrally arranged steam outlet pipe, surmounting the top of the boiler shell, provided with transverse branches each having a valve and extending laterally, downwardly and across the fire box and longitudinally parallel with the boiler shell and beneath and upwardly into their respective drums, longitudinal tubular headers, each having a perforated lower half with which the branch pipes connect and an imperforate upper half and twin frames whereby the tubular headers are supported centrally



within their respective drums, water supply connection, provided with branches each having a valve and connected with the top of the drums and blow off pipes having valves and connected with their respective drums.

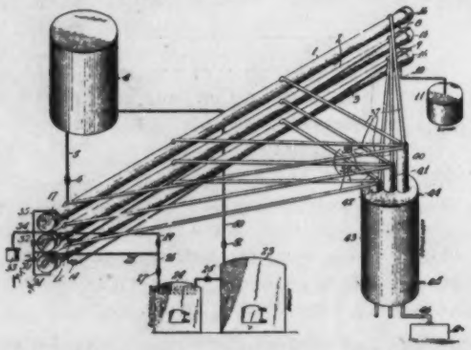
998,625. Fuel Press. David C. McCan, Los Angeles, Cal. In a fuel press, the combination with a casting having a semi-cylindrical groove and a feed chamber mounted thereon, of a sector provided with a shoe having a semi-circular groove,



and arranged to form with said semi-circular groove in said casting, a complete cylindrical mold, a gate to close the feed chamber and compress the material against said sector and means to operate said gate and sector.

998,837. Process of Refining Oil. Hubert G. Burrows, Orcutt, Cal. The process of refining oil containing finely divided mineral matter in suspension, which consists in distilling the oil with sufficient rapidity to cause the finely divided mineral matter to pass into the distilled product and condensing the distilled product into liquid form, and allowing the mineral matter to settle out from the oil.

The process of separating finely divided mineral matter



from an oil of sufficient viscosity to hold said mineral matter permanently in suspension.

INDUSTRIAL

POWER FACTOR METERS.

A poor power factor can often be improved by a better proportioning of the motors to their loads, the use of a super-excited synchronous motor, or similar means, with resulting increased capacity and efficiency of the system. It is therefore important, particularly in heavily loaded plants, to know what the actual power factor is at various conditions of load. To do this it is not necessary, as it once was, to take readings of voltage, current and power and to calculate from these the ratio of true to apparent watts. The introduction of direct-reading power factor meters has made calculation unnecessary and enables the determination of the power factor without trouble. Their use indicates whether induction motors on a system or on any circuit of a system are being properly operated, and enables the adjustment of the exciting current of synchronous apparatus to values giving the most economical power factor, also indicating a reversal of power if it occurs.

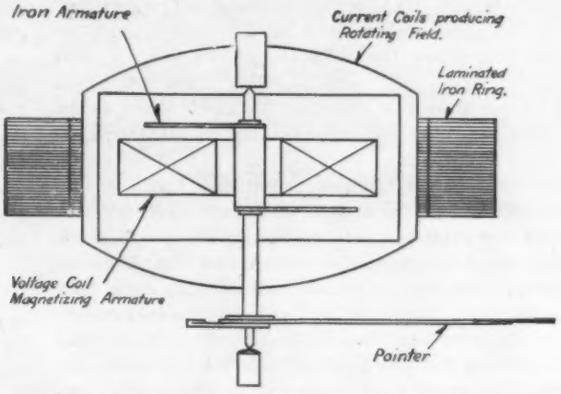


Fig. 1. Outer Damping Disk and Rotating Field of New Power Factor Meter.

On polyphase systems supplying a mixed load, power factor indications are a necessity, as the calculation of power factor from other meters is very complicated and difficult and may give very misleading results. A polyphase power factor meter having current connection in each phase of the circuit will indicate the average power factor of all the phases.

Fig. 2. New Type of Power Factor Meter.

The illustrations show four types of direct reading power factor meters manufactured by the Westinghouse Electric & Manufacturing Company. These meters indicate on a graduated scale the power factor in the circuit to which they are connected.

The power factor meter operates on the rotating field principle. A rotating field is produced by the current of the metered circuit passing through angularly placed coils. In this rotating field is situated a pivoted iron vane or armature, magnetized by a coil whose current is in phase with the voltage of one phase of the circuit. As the iron vane is attracted or repelled by the rotating field of the current coils, it will take up a position where the zero of the rotating field occurs at the same instant as the zero of its own field. Thus its position will always indicate the phase angle between the voltage and current of the circuit. The pointer attached to the armature therefore indicates this angle, and, by marking on the scale the cosine of the angle shown by the graduation, the power factor is read directly. In the three-phase meter the rotating field is produced by three current coils spaced 60 degrees apart; in the two-phase meter by two current coils spaced 90 degrees; in the single-phase meter the position of voltage and current coils is interchanged and the rotating field is produced by means of a split-phase winding.

Fig. 1 illustrates the movement of a type SI seven-inch power factor meter. The winding shown within the iron ring is the stationary winding of the current coils. Inside this and not shown, are the stationary voltage winding and the pivoted armature. The laminated iron ring surrounding the winding is provided as a return circuit for the flux of the pivoted armature, so that the reluctance of the armature magnetic circuit is low and uniform in all positions. These parts are shown in the diagrammatic cross-section, Fig. 1.

An aluminum disk shown in Fig. 1 at the front of the meter is a damping disk, moving in the concentrated field of the two permanent magnets at the bottom of the mechanism. These magnets and disk have no effect whatever on the electrical operation of the meter. They serve to absolutely prevent oscillations of the pointer and thus make the readings "dead-beat." The pointer therefore does not swing back and forth but comes to rest at once at its correct position. More efficient damping is obtained with this electromagnetic device than is possible with air damping devices, unless a delicate and easily deranged adjustment is resorted to.

It will be noted that in this form of power factor meter

no connection is required between the fixed and the moving elements; there being no movable coils used, there are no delicate flexible connecting strips; nor is any control spring necessary, as the controlling force is electromagnetic. The moving element is therefore very light, and the friction and bearing jewel wear a minimum.

All the Westinghouse switchboard types and the polyphase portable types are arranged to read lagging or leading power factor on the upper half of the scale and for reversed power on the lower half. The switchboard types are adjusted for one standard frequency; the polyphase portables are adjustable to any frequency between 25 and 60 cycles. The single-phase portables indicate for 60 cycles on one-half the scale and for 25 cycles on the other half. The portable meters are very convenient for investigating the power factor of motor loads and assist very materially in improving the operation of the system.

A NEW MOISTURE-PROOF DRY BATTERY.

Where considerable moisture is prevalent it sometimes happens that the cardboard cartons of dry cells absorb so much moisture that when the cells are placed side by side or on a metallic base, they become short circuited. This causes them to run down and deteriorate quickly, thus necessitating frequent renewals and an attendant maintenance expense.

The Western Electric Company, realizing this, has recently placed on the market a new, moisture-proof dry battery. This cell has been designed especially for use in mine, railway and general telephone service where the batteries are subjected to moisture. The new cell has the same high efficiency, long life, high voltage and great recuperative power which characterizes the standard "Blue Bell" battery. It differs from the standard cell in that the cardboard carton has been treated with a special impregnating compound which effectually prevents moisture from reaching the cell proper. This will give sufficient protection so that the life of the batteries used in damp places will be as great as that of the batteries used in any other magneto service under ordinary conditions.

BOOK REVIEW.

Straight Line Engineering Diagrams. By Manifold & Poole, Pocket size, 4½x7½ inches; 96 pages, 44 line drawings; 5 half-tones illustrating emergencies in engineering; clear type; strong paper; durable bindings. Published by Technical Publishing Co. and for sale by Technical Book Shop, San Francisco. Price $3.00.

Briefly this book in convenient pocket form contains forty-four carefully compiled diagrams from which data relating to transmission lines, pipes, canals, concrete, steel, wires, and practically every problem coming up in the practice of the engineering profession is solved at a glance. In the rear are five illustrations, covering emergencies or what is to be done in case of electrical and other accidents.

Manifold & Poole, engineers, Los Angeles, California, put into ready graphical shape in this work not only formulae in common usage among engineers, but also the clever ideas gathered from a wide and varied practice.

Every engineer is experiencing daily the long felt want for some self-speaking volume of ready data. Let us cite by illustration: A friend drops in upon an electrical acquaintance. The friend is figuring up a prospect in the way of an irrigation enterprise and wants to know quickly the approximate size of a ditch to convey given amounts of water and approximately the yardage to be excavated. The electrical engineering acquaintance let us say is an expert in matters electrical. Ask him anything about voltage, size of conductors, transmission lines and the like and he gives you the data from the pigeon-hole in his brain at once. But now here is an irrigation problem before him. His mind runs back to years ago when last he used Kutter's Formula. It takes him an hour or two to figure out correctly the rough data his friend desires. Again the civil engineer has constantly propounded to him questions of engineering he cannot readily answer.

This little book, if carefully examined, will be found bubbling over with just the ready information desired and the ease and rapidity with which the diagrams can be read will always remain a mystery to the uninitiated. The book should be in the pocket of every engineer.

Testing of Electro-Magnetic Machinery and Other Apparatus. By B. V. Swenson and Budd Frankenfield, assisted by J. M. Bryant. Size 5½ x 8½ inches; 324 pages. Profusely illustrated line drawings. Published by The Macmillan Company, New York, and for sale by Technical Book Shop, San Francisco. Price, $3.00 net.

The methods employed in this book setting forth the laboratory tests for the electrical engineering student combine the practice and suggestion of half a dozen or more university laboratories as well as suggestions from the laboratories of such electrical manufactories as Allis-Chalmers Company. The book has been tried out in mimeograph form in the classroom for the past six years and represents a product of such correction and remodification that it is believed will meet more nearly the classroom needs than any book yet published of this nature. The arrangement is logical. Each series of tests begins with a list of standard references. The object is thus set forth to focus the student's attention and this is followed by the author's theory and method. The book comes upon the scene at a time most welcome to those interested in electrical engineering laboratory tests.

Walker's Manual of California Securities and Directory of Directors, 1911 Edition. Edited, compiled and published by H. D. Walker, San Francisco, Cal. Size, 6 x 9 inches; 472 pages. Replete with data relative to California securities. For sale by Technical Book Shop, San Francisco. Price, $3.00 net.

The new publication contains many valuable features over its predecessors. Not only is definite information given regarding the number of corporations and their securities which are listed on the Exchange and dealt in by the public, but a number are compiled which are not listed on the Exchange, but which are dealt in by the public. This represents much new and valuable information. The Directory or Directors has also been added to and made more complete. The book is invaluable to those holding securities in the great power companies and other public service corporations of California.

NEW CATALOGUES.

The D. &. W. Fuse Company of Providence, R. I., have just published Catalog No. 15, containing a complete line of fuses, cut-outs, boxes, etc. The publication is well illustrated and attractive in appearance.

The Ohio Brass Company have just published Supplement No. 2 which contains many interesting and important improvements in various materials listed in their former catalogs on railway, mine, catenary and O.B. Hi-Tension specialties.

The General Electric Company has just issued a very attractive publication in Bulletin 4855, devoted to a detailed description of its double truck type of gas-electric car. The publication is elaborately illustrated, and contains considerable data relative to the subject. It includes plans and elevations of cars of various sizes. In Bulletin No. 4863, recently issued by the company, is described that company's Gem lamp. This lamp is intended to replace the carbon lamp as a free renewal lamp. The bulletin compares the carbon with the Gem lamp and shows the advantages derived by the use of the latter.

NEWS NOTES

FINANCIAL.

OROVILLE, CAL.—The Oro Water, Light & Power Company has been cited to appear before the Board of Equalization to show why its assessment on certain non-operative property should not be increased from $12,950 to $50,000.

LOS ANGELES, CAL.—The City Council has passed an ordinance providing for the issuance of $3,500,000 of Electric plant bonds of the city authorized at a special election held April 19, 1910. The bonds to be $1000 each, dated June 1, 1911, bearing 4½ per cent interest, payable semi-annually.

MORGAN HILL, CAL.—Sealed bids will be received by the clerk of the Board of Trustees at the town hall, up to August 10, 1911, for the purchase of the whole or any part of the $13,000 bond issue, for the acquisition and construction of a system of waterworks. The bonds are 26 in number of the denomination of $500 each, bearing interest at the rate of 3 per cent per annum.

SACRAMENTO, CAL.—That $1,500,000 will be spent by the Citizens' Light & Power Company of this city, a subsidiary of the Great Western Power Company, was announced last week by George W. Peltier, president of the company. This money will be expended in putting in an underground conduit system and wiring the city for electric lighting and for power. The company will file articles of incorporation, with $5,000,000 as capital stock, some time this week. It will commence operations at once.

SAN FRANCISCO, CAL.—Through a $2,000,000 bond deal closed in New York by the promoters of the Antioch & Oakland Railroad the extension of the road into Oakland and Stockton is now asssured. The new road has a traffic agreement with the Key Route which will permit its cars to reach the pier of that system and to run to the heart of Oakland. The new company also holds a franchise along Shafter avenue in Oakland in the name of the Oakland and Bay Shore Railroad. Two blocks of land at Shafter avenue and Fortieth street will be the operating headquarters, where the line will connect with the Key Route. The Anglo-California Trust Company will act as trustee in the bond deal.

SAN FRANCISCO, CAL.—The Spring Valley Water Company has applied to the Supervisors for a reduction of its assessment in San Francisco to the extent of $2,746,199. Assessor Dodge this year assessed the company as follows: Real estate, $3,056,000; improvements, $811,580; city pipe system, $6,000,000; personal property, $977,260; total, $10,844,840. The company asks that the city pipe system item be reduced to $4,119,298, and that the assessment of its personal property be lowered to $111,763. It was assessed last year for $10,774,453, the items being: Real estate, $3,365,800; improvements, $4,874,768; personal property, $333,885; franchise, $2,500,000. Under the new tax system franchises are assessed by the State Board of Equalization only, the company says in its application, and this board, against the company's protest, has fixed the value of the Spring Valley franchise for the purpose of taxation this year at $3,619,600. The company will have to pay the State $36,196 on this franchise alone.

INCORPORATIONS.

SACRAMENTO, CAL.—The Citizens Light & Power Company has been incorporated with $2,000,000 preferred and $3,000,000 common stock and authorized to make a bond issue of $2,500,000.

SAN BERNARDINO, CAL.—Amended articles of incorporation of the East Redlands Water Company have been filed, capital $100,000; place of business, Redlands. The original incorporators were H. L. Drew, Lewis Jacobs, H. M. Barton.

LOS ANGELES, CAL.—The Glendora Independent Water Company has been incorporated with a capital stock of $200,000, subscribed $300. The incorporators are W. G. Hall, A. E. Englehardt and L. J. Goff.

LOS ANGELES, CAL.—The Baldwin Park Water Company has been incorporated with a capital stock of $100,000, subscribed $5000. The incorporators are Wm. Stevenson, W. H. Townsend, Solon Newton, C. H. Angel and J. C. DeMandel.

ILLUMINATION.

KENNET, CAL.—The Sacramento Valley Power Company has applied to the Board of Trustees of the city of Kennet for a franchise.

SUMAS, WASH.—The citizens of Sumas have decided to take advantage of the offer of the British Columbia Electric Company to furnish electric power and light to the town of Sumas.

FORT MASON, CAL.—Sealed proposals in triplicate for furnishing all material and labor and installing an electric lighting system at Fort Miley, Cal. were received here up to August 3, 1911.

SACRAMENTO, CAL.—J. Frank Robinson, cashier of the Sacramento Electric, Gas & Railway Company, has made the definite statement that the company will build a new home on SE. Eleventh and K streets. The property was purchased several weeks ago by Geo. H. Rand of San Francisco.

SANTA MARIA, CAL.—The Board of Supervisors has granted a franchise to lay pipes and sell gas in the county to R. E. Easton and others, representing the Santa Maria Gas Company, for $100. They will extend the mains from Santa Maria to Nipomo and Arroyo Grande, then to San Luis Obispo.

MERCED, CAL.—Mr. Walthal, commercial agent for the San Joaquin Light & Power Company, has been in Merced and gave out the information that a new gas rate had been made by his company to go into effect at an early date. New mains are to be extended to new houses as fast as constructed. A large number of the old mains are to be regraded.

MILL VALLEY, CAL.—The Mill Valley Gas & Electric Company, recently incorporated, has applied to the town trustees for a franchise to lay mains in the streets of the town and will install a $100,000 gas plant to supply Sausalito and this place with gas. The directors of this company are Dr. Ferdinand Butterfield, E. de Los Magee and J. Schlingmann.

SAN BERNARDINO, CAL.—The Board of Supervisors has sold a blanket gas main franchise covering all county highways in this county, except a small area previously covered in the city, to the Southern California Gas Co. Work is to be started within four months and to be completed within three years. The central distributing plant will be constructed in this city with radiating laterals to many points in the valley.

RICHMOND, CAL.—The contract for sinking the gas well at Richmond and Tunnel avenues in this city, has been let to D. S. Valentine of Oil Center. He will bring his machinery here at once to start work. The derrick, 80 feet high, has already been erected by the company. Valentine is to drill 2000 feet, and at this depth, if the indications are right and the best flow has not been struck, additional machinery will be

installed and the well will go down perhaps another thousand feet. John Nicholl, J. R. Nystrom, Contractor Cruickshank and other local men are financing the project.

TRANSMISSION.

LOS ANGELES, CAL.—Instructions have been given by the Board of Supervisors for the installation of an electric power line between the Kern River station of the Pacific Light & Power Company, near Eastlake park and the county hospital, to utilize the 50 h.p. due the county from that corporation.

TUCSON, ARIZ.—H. A. Smith has taken steps toward the establishment of a big power and irrigation project near Noria, Sonora, which will furnish power to four mines and smelters and the town of Llano and water for irrigation of 15,000 acres. A reservoir site near Noria has been selected. A flour mill is also in contemplation for Llano. Engineers are at work on the project.

LOS ANGELES, CAL.—Henry C. Huntington, W. G. Kerckhoff and A. C. Balch have launched an electrical power enterprise, with headquarters in Los Angeles, which will control practically all electric power in the San Joaquin Valley south of Fresno and a large percentage of that to be used in Southern California. The deal involves an ultimate bond issue of between $40,000,000 and $50,000,000; and the construction of one of the largest hydroelectric power plants in the world.

RENO, NEV.—The work of surveying for the construction of the new power and light plant which is planned to be built east of this city, is going on rapidly. The men behind the company are keeping their identity from the public, but have a number of men employed. The work of actual construction will soon commence. The company has secured former City Electrician W. E. Caffrey of Reno as its chief electrician, and he will supervise the construction of the plant. He says that it will be the largest on the Truckee River when completed, and will develop 5000 h.p.

FRESNO, CAL.—According to G. O. Newman, chief engineer of the Pacific Light & Power and the San Joaquin Light & Power Companies, who has come here after an inspection of the site of the proposed hydroelectric plant at Big Creek, near Shaver, that establishment will supply power both around San Francisco Bay and in the Los Angeles district. "The Big Creek plant will be the largest of its kind in the United States," said Newman, "and will develop, when completed, power representing 300,000 h. p. It will supply power for a great distance both around San Francisco and around Los Angeles. We control nine plants now in this State and in Arizona, and could use more power even now. The site is an ideal one for that purpose."

FRESNO, CAL.—The first link in the chain of power lines and sub-stations that will give Bakersfield and the West Side oil towns additional and far more adequate power facilities, generated at the Crane Valley plant of the San Joaquin Light & Power Company, is to be completed and the high tension will be put on the Moron line out of Bakersfield. In a few more days, the Bakersfield transmission line from Crane Valley will be cut in, and the big system will be working. The Coalinga power line, which now runs out from Fresno to the oil city by way of Hanford, is to be cut out for a few hours, to put in connections at the Henrietta sub-stations, west of Lemcore, with the Bakersfield line. When the Bakersfield line is in operation, this Henrietta station will tap it and furnish power in one direction to Hanford and in the other to Coalinga. The survey of the line to be run out over the west side by way of Dos Palos, Los Banos and Gustine is just completed, and the surveyor's figures were submitted. Material is being assembled for the work of constructing this line, and the actual work will begin in the course of the week.

TRANSPORTATION.

SEBASTOPOL, CAL.—The Board of Trustees has granted to the Petaluma & Santa Rosa Railway Company for a period of 50 years, a franchise to construct a standard gauge electric railroad within the town of Sebastopol.

SANTA ROSA, CAL.—Actual work of construction on the Santa Rosa and Clear Lake Railroad will be begun here within 15 days. The construction will begin at the city limits of Santa Rosa, and J. W. Barrows, who is a roadmaster with the Western Pacific railroad at Horncut, will come here and take charge of the construction work. The road will be run out by Burke's Sanitorium, Mark West Springs, the Petrified Forest and by Kellogg, at the site of the proposed Manual Training School, to be established by the State. From there it will enter Lake County and tap many of the principal springs and watering places of that county, while it will also reach Middletown, Lower Lake and Lakeport. The road is to be a narrow gauge, and either gasoline motors or electricity will be used as motive power.

STOCKTON, CAL.—With the announcement that the Tidewater and Southern Electric Railway, which is being built between Stockton and Turlock via Modesto, will begin operations in October, the statement was also given out of the general office yesterday that negotiations are pending with the Western Pacific to lease the track of that line from Ortega, on the old Tesla line, to the water front in Stockton. This will make it possible to make freight shipments from as far south as Turlock to this point and thence via water to San Francisco, establishing an entirely new transportation line from valley points to the bay city. Another consignment of rails for the new road is due to reach French Camp in a few days. Grading is being rushed, and, as the road runs through a comparatively level country, this part of the work will soon be completed. The steel bridge across the Stanislaus River is also well under way.

STOCKTON, CAL.—Contrary to report emanating from San Francisco, to the effect that the Western Pacific may purchase the San Joaquin Valley Electric Railroad as an entering wedge into the valley, Morris L. Brackett declares the electric line will be completed as planned and will not be converted into a steam road. It was intimated that there was a probability that the Western Pacific will use the electric line as a feeder, but will not operate steam trains over the rails. The San Joaquin Valley Electric Company is now operating at Modesto, having transferred its operations from French Camp to that city in order to hold its franchise. The fact that the Stockton-Modesto road is to use a mile and a fifth of the Western Pacific's tracks, indicates that there may be some agreement between the two lines. Mr. Brackett states that the electric line will use the old coal road tracks from the southern limits of the city to the intersection with the Southern Pacific.

TELEPHONE AND TELEGRAPH.

NAPA, CAL.—The Board of Supervisors has passed an ordinance granting a franchise to W. M. Lyons, for a period of 50 years, to erect telephone lines in the county of Napa.

SALT LAKE CITY, Utah.—At a meeting of the directors of the Rocky Mountain Bell Telephone Company a consolidation was effected with the Colorado Telephone Company and the Tri-State Telephone & Telegraph Company. The new corporation is to be henceforth known as the Mountain States Telephone & Telegraph Company.

SAN FRANCISCO, CAL.—Mr. Cobbe, head of the Pacific Telephone & Telegraph Company's engineering department with offices in the New Montgomery Street Exchange, has awarded the contract for the construction of the new building for the company in Spokane to H. J. Skinner of that city on his bid of $98,000. The structure will be of the class-A type and will house the company's main office in Spokane. The

plans for a three-story and basement brick structure for the same purposes, which is to be erected in Los Angeles, are complete and figures for the construction are being taken. The Los Angeles work will cost about $35,000. The next building which will come up for figures will be the Fresno exchange.

WATERWORKS.

GLADSTONE, ORE.—This place will vote on a bond issue of $20,000 for the construction of a water system.

OCEAN PARK, CAL.—Joe Shatuck of Los Angeles, who has the contract for laying water mains for the municipal water plant, under the recent bond issue, will commence work at once.

YERINGTON, NEV.—The Council has passed a resolution authorizing the Mayor and Clerk to sign up an agreement with Engineer Green to begin surveys for a municipal water system as soon as possible.

PRESCOTT, ARIZ.—The business men of the city have begun a well organized effort to secure a better and less expense water supply for the city. The council has been asked to appropriate a sum for drilling an experimental well.

SPOKANE, WASH.—Plans have been ordered prepared by Commissioner Fassett for laying a new main line into the north hill district from the up-river pumping station at a cost of $130,000 for the relief of the north Hill water shortage.

RIVERSIDE, CAL.—The committee appointed by the Mayor to investigate the matter of municipal ownership of the water system, reported in favor of the purchase of the Riverside Water Company, the Artesia and Kees plants. The estimated cost of the proposed purchase is $850,000.

ELMA, WASH.—The water ordinances providing for the issuance of $10,000 in bonds for the extension of the waterworks system and for a special election to be held on July 26th, to give the citizens an opportunity to reject or accept the issue, has been passed by the council.

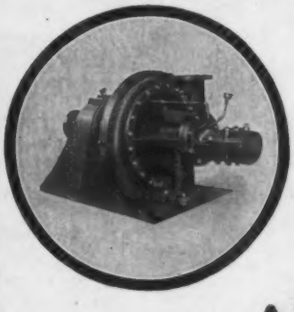
LOS ANGELES, CAL.—Workmen are now clearing and improving the Tejunga orange site in San Fernando valley, recently placed on the market by George C. Peckham Company. Large pipes will be used for conveying water to this land from a canyon three miles away. The contract for concrete pipe for irrigating the land has been awarded at $6500. Plans are being prepared for a concrete reservoir with 228,000 gallon capacity.

RICHMOND, CAL.—The United Properties Company is beginning to turn its attention toward Richmond and take up its plans for development here. The survey for the double tracking of the electric railroad from the county line has been completed as far as Twenty-third street and Macdonald avenue and will be carried along Macdonald avenue to the Santa Fe station. As soon as Ashland avenue, the big, new connecting thoroughfare, is completed, the line will be double tracked across it and extended to the Standard Oil works, now reached by a single track.

SAN FRANCISCO, CAL.—Just as the city is about to close the option with William Ham Hall and the Tuolumne Water Supply Company and acquire the Cherry Creek water rights and properties of the Lake Eleanor system for $652,000 an effectual block to the transaction is applied with the filing of a suit to quiet title to the properties in question by the National Park Electric Power Co. The suit has been brought in Sonora, county seat of Tuolumne County, and names the city and county of San Francisco as co-defendants with William Ham Hall and the Tuolumne company. The National Park Electric Power Company claims prior title to all of Hall's claims in Cherry Creek. Judge J. P. O'Brien and Milton S. Hamilton are the attorneys for the National Park Company. In discussing the suit Judge O'Brien declared that the rights of the National Park Company include all of the rights which are offered to the city by Hall. The suit is merely a case to quiet title to the properties and in itself will not act as an injunction restraining the payment of the $652,000 to Hall and his company, but it is expected that a taxpayers' suit will be filed to effect such an injunction.

SUMAS, WASH.—This city has made a 10-year contract with the British Columbia Electric Railway Company, or its subsidiary power concern, for furnishing power to the city of Sumas, as the result of a recent election in that town. The company will merely furnish the current, the power and lighting question within the city of Sumas being entirely in the hands of a civic body appointed for the purpose. This incident is of interest as it is stated to be the first time that the British Columbia Electric Railway Company has supplied power without the borders of the Dominion and in view of the agreement between the United States and Canada regarding transmission of power across the border.

SAN FRANCISCO, CAL.—Plans have been prepared by the Pacific Gas & Electric Company to develop an additional 71,000 hydroelectric horsepower at a cost of about $10,000,000. The additional capacity will bring the company's total horsepower up to 260,000, including steam plants of over 96,000 horsepower. The company now serves about 33,000 square miles in Central California and has about 1100 miles of high transmission lines. The plans provide for the erection of a dam in the canyon of the South Yuba River, which will increase the present water storage from fifteen lakes in Nevada and Placer counties by 2,500,000,000 cubic feet. Two plants will be constructed: the first, having a head of 1647 feet, will develop 50,000 horsepower; the second, which will use the water again, will have a fall of 750 feet with a capacity of 21,000 horsepower. The overflow of water is then used for irrigation purposes.



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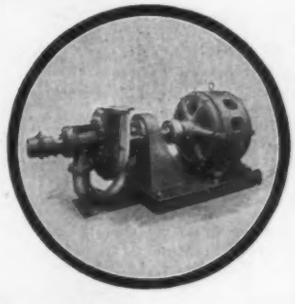

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Schaw-Batcher Co..... 5
Sacramento, Cal., 211 J.
San Francisco, 356 Market.

Southern Pacific Co.....16
San Francisco, Flood Bldg.

Sprague Electric Co.....12
New York City, 527-531 W. Thirty-fourth.
San Francisco, Atlas Bldg.
Seattle, Colman Bldg.

Standard Und. Cable Co.... 16
San Francisco, First National Bank Bldg.
Los Angeles, Union Trust Bldg.

T

Technical Book Shop.....11
San Francisco, 604 Mission.

Tracy Engineering Co.....
San Francisco, 461 Market.
Los Angeles, Central Bldg.

Thomas & Co., R.....
New York, 227 Fulton.
East Liverpool, Ohio.
San Francisco, 680 Folsom.
Oakland, 507 Sixteenth.
Los Angeles, 119 E. 7th.
Seattle, 1518 1st Ave. So.

W

Wagner Electric Mfg. Co....
St. Louis, Mo.
San Francisco, Balboa Bldg.

Western Electric Co..... 5
San Francisco, 680 Folsom.
Oakland, 507 Sixteenth.
Los Angeles, 119 E. Seventh
Seattle, 1518 First Ave. So.

Westinghouse E. & M. Co... 6
Pittsburg, Pa.
Denver, 1052 Gas & Elec. Bldg.
Los Angeles, 527 So. Main.
Seattle, Central Bldg.
Salt Lake City, 212-214 So. W. Temple.
San Francisco, 165 Second.
Spokane, Columbia Bldg.
Portland, Couch Bldg.
Butte, Lewisohn Bldg.
Canada, Canadian - Westinghouse Co., Ltd., Hamilton, Ontario.
Mexico., G. & O., Braniff & Co., City of Mexico.

Westinghouse Machine Co..
Pittsburg, Pa.
San Francisco, 141 Second.

Weston Elec. Instrumt. Co.. 3
Waverly Park, N. J.
New York, 114 Liberty.
San Francisco, 682 - 684 Mission.

Wilbur, G. A..... 2
San Francisco, 61 Second.